JAN 7 1926

PAPER TRADE JOURNAL

PAPER THE MAGAZINE

Is Combined with Paper Trade Journal

Vol. LXXXI. No. 27 DECEMBER 31, 1925 Per annum, $4.00 Per Copy, 10 cents

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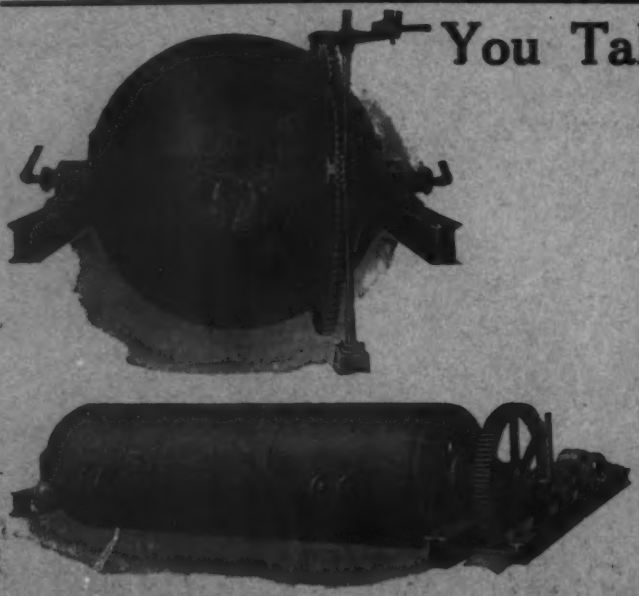

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PAPER TRADE JOURNAL
ESTABLISHED 1872

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD
FIFTY-FOURTH YEAR

Published Every Thursday by the
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A New Trademark

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Paper and Pulp Mill Machinery
EAST DOWNINGTOWN, PA., U. S. A.

ESTABLISHED IN 1872

PAPER TRADE JOURNAL

With Which Is Combined

PAPER

The Magazine of the Paper Industry

Vol. LXXXI, No. 27 — Thursday, December 31, 1925

Meetings At Annual Convention of A. P. & P. A.

Paper Week Will Begin Monday, Feb. 22 and Be Concluded With the 49th Annual Banquet of the American Paper and Pulp Association Thursday Evening, Feb. 25—Numerous Meetings, Luncheons and Dinners of the Various Affiliated Associations Scheduled Throughout the Week

The preliminary schedule of meetings for the annual convention of the American Paper and Pulp Association, which has just been arranged, is as follows:

MONDAY, FEBRUARY 22, 1926.

Forenoon

9:30 Technical Association, Rooms 109, 110, 151.
10:00 Cost Association of the Paper Industry, Room 151-B.

Afternoon

2:00 Technical Association, Rooms 109, 110, 151.
2:00 Cost Association of the Paper Industry, Room 151-B.
2:30 Southern Kraft Manufacturers' Association, Room 112.

TUESDAY, FEBRUARY 23, 1926

Forenoon

9:30 Technical Association, Myrtle Room.
10:00 Cost Association of the Paper Industry, Room 151-B.
10:00 Tissue Paper Manufacturers' Association, Room 110.
10:30 Converting Paper Mills Association, Room 114.
10:30 American Waxed Paper Association, Rooms 100, 101.
10:30 Salesmen's Association, East Room.
10:30 U. S. Pulp Producers' Association, Room 109.

Afternoon

1:00 American Waxed Paper Association, Room 100, 101. (Luncheon), Room 112.
1:00 Cost Association of the Paper Industry, Room 151-B. (Luncheon), Room 115.
2:30 Cover Paper Manufacturers' Association, Room 110.
2:30 Technical Association, Myrtle Room.
2:30 Tissue Paper Manufacturers' Association, High Grade Division, Room 109.

Evening

7:00 Technical Association, Hotel Commodore.
7:00 Tissue Paper Manufacturers' Association (Dinner), Hotel Astor.
7:00 Salesmen's Association (Dinner), Roof Garden, Waldorf.

WEDNESDAY, FEBRUARY 24, 1926

Forenoon

9:30 Technical Association, Room 151, Myrtle, 110.
10:00 Cost Association of the Paper Industry, Room 151-B.
10:00 Writing Paper Manufacturers' Association, East Room.
10:30 Cardboard Manufacturers' Association, Room 109.
10:30 Wrapping Paper Manufacturers' Service Bureau, Tea Lounge.
10:30 Woodlands Section, Room 115.

Afternoon

12:30 Paper Makers' Advertising Club (Luncheon), Room 112.
2:00 Technical Association, Rooms 151, Myrtle.
2:30 Glazed and Fancy Paper Manufacturers' Association, Room 114.
2:30 Southern Kraft Manufacturers' Association, Rooms 100, 101.
2:30 Writing Paper Manufacturers' Association, Fine Paper Division, Room 109.
2:30 Writing Paper Manufacturers' Association, Middle Grade Division, Room 110.
2:30 Woodlands Section, Room 115.
2:30 Cost Association of the Paper Industry, Room 151-B.
2:30 Writing Paper Manufacturers' Association, Sulphite Bond Division, East Room.

THURSDAY, FEBRUARY 25, 1926

Forenoon

9:30 Technical Association, Rooms 109, 110, 151.
10:30 American Paper and Pulp Association, annual meeting, Astor Gallery.

Afternoon

1:00 Binders' Board Manufacturers' Association (Luncheon), Room 112.
1:30 President's Luncheon (Advisory Council), Room 115.

Evening

7:00 A. P. P. A. Reception, Astor Gallery.
7:30 A. P. P. A. 49th Annual Banquet, Grand Ball Room. Information and Press, Room 106.

Over $12,000,000 to Be Spent on New Mill

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 28, 1925.—Between $12,000,000 to $15,000,000 will be expended by the English and Canadian interests now concerned in the construction of a new pulp and paper mill on the shores of the St. Charles River. Notwithstanding the denials given to the recent report regarding the plans of the Anglo-Canadian Pulp and Paper Company, which includes the Rothermere and Clarke interests, it has been learned officially that Premier Taschereau has been advised that the construction of the huge plants will start early next spring. It is expected that a daily output of 400 tons of paper will be available when the mills are built, and that 1,000 men will find employment. The pulpwood will be supplied by the large area of timber limits located along the Manicougan River on the north shore, which were leased by auction two years ago by the Clarke interests. According to the lease, work had to be started within eighteen months after the leasing, and already this fall some preliminary work was made at the point chosen on the St. Charles. It is understood that the whole output will be sent to England.

Big Demand For Seasonal Paper In Philadelphia

Unprecedented Holiday Activity is Reflected In Unusually Good Demand For Various Lines of Paper—Kraft Prices Show More Stability—Plans for Paper Making Exhibits at Sesqui Centennial Discussed at Quarterly Meeting of the Philadelphia Association

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 26, 1925.—An unprecedented holiday activity in the mercantile industries enabled the paper merchants to dispose of a large volume of grades that were especially adapted for this seasonal distribution. The Christmas business of belated purchases or demands for replenishing depleted stocks was of much larger proportions than anticipated and extended all through the coarse paper specialties needed for wrappings or containers of holiday gift merchandise. While most of the week's buying was for Christmas requirements there was some look ahead on the part of a few of the consumers of papers in the fine paper group and contracts were placed for next year's deliveries of special grades. There also was urgent demand for specialized grades in the fine paper division among those lines used by the greeting card manufacturers.

Coated Papers Lead Holiday List

While coated papers were the dominating factors of distribution in the fine paper stocks that just now are wanted for next year's restocking, there nevertheless was a steady market for specialties for some grades that are principally used by the engraving and greeting card manufacturing trades. The demand for coated papers came from the large printing and publishing houses that are looking ahead into the new year when contracts now placed become effective. There apparently is little apprehension among the paper men or the consumers over the price situation for the coming year and orders are readily booked without haggling over prices. It may be that the present mill situation is responsible for the ready response to requests by paper salesmen that orders for next year's contracts in book papers and coated grades be given and are convincing the consumer that he had better be prepared ahead for the first months of the new year. The paper men have been notified by coated paper manufacturers that they are sold anywhere from four weeks to ten weeks ahead of their present capacity production and that the distributor must await his turn before orders can be filled. This information is being passed along to the consumer who already is low of stocks and is a convincing sales argument for preparedness and meets ready response in good sized contracts. There was enjoyed by the distributors of greeting card stocks the largest business in the history of the trade, this year's demand for greetings having overtopped that of any former period. Pending the closing of the inventory season now in swing there has been little demand for any of the other grades customers preferring to hold off their purchasing until after a record has been made of stocks on hand.

Krafts More Stabilized

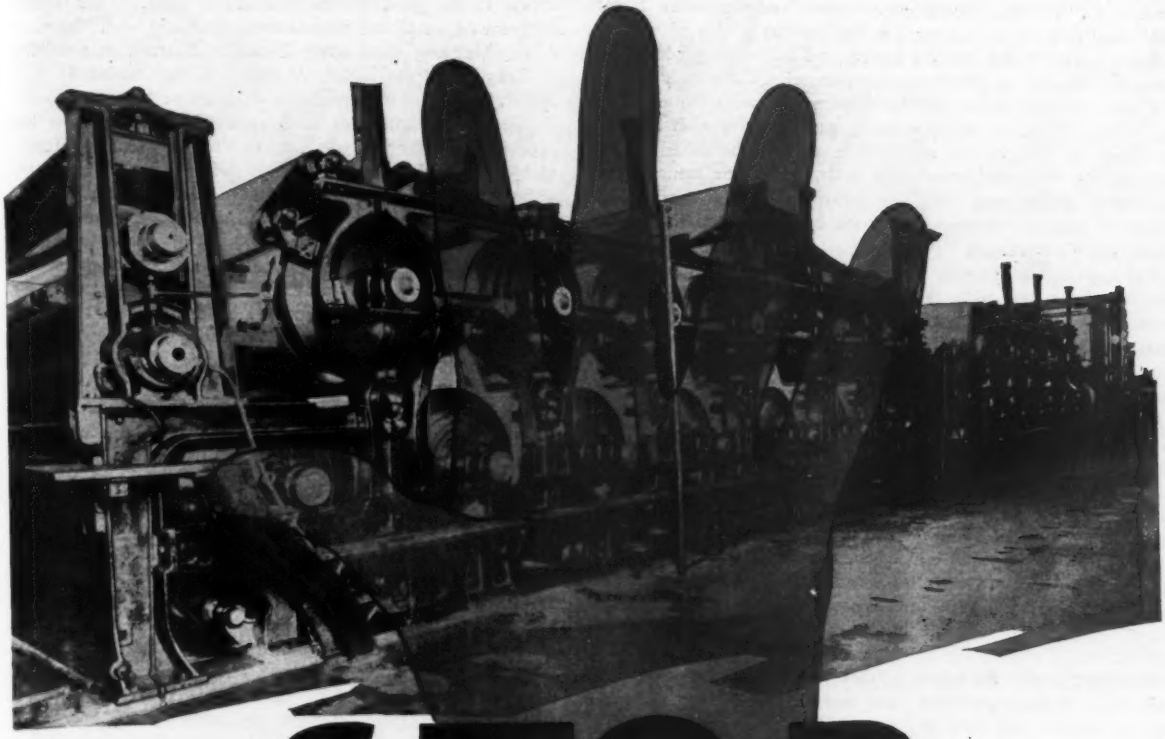
Although there was some apprehension over the kraft market a few weeks ago and the prospects that prices were being relegated to the low levels of the early year by the announcement of a couple of manufacturers that these products might be purchased at from 4¼ to 4½ cents per pound in a special offer made at that time, the price situation has been more stabilized within recent days. Since these quotations were made no other offerings have been forthcoming from the mills. It is now believed that the cut into values was made merely to clean up on "hang over" stocks in the mills or to secure ready cash and no further inroads will be made on krafts at this time. As to the jobber who offered similar values to his competitors in the Philadelphia trade, it has been learned that his drive was made for the purpose of reducing stocks on hand prior to the taking of inventory. Distributors specializing in box makers papers report an excellent holiday demand for all the fancy grades with a fairly well maintained demand for the standard cover papers in both the glazed and dull finished stocks used for ordinary industrial purposes. Demand for board also was well maintained up to the last days of holiday buying and although no heavy orders were placed there was sufficient broadening of the Christmas market to warrant the maintenance of the quotations made when prices were advanced in October to $47.50 to $50 for news and chip respectively.

Paper Making Exhibits For Sesqui-Centennial

Now that the year which will mark the passing of the 150th mile stone since the signing of the Declaration of Independence is near, the paper trade is giving earnest thought to the exhibit to be featured at the Sesqui-Centennial Exposition to be held during 1926 in commemoration of the anniversary of the signing of the Declaration. At the final 1925 quarterly meeting of the Philadelphia Paper Trade Association held last Saturday in the Typothetae headquarters, 10th and Walnut streets, the paper exhibit to be carried out at the Exposition to open in July of 1926 was the principal topic discussed. With Vice-President Simon Walter, of the Paper Trade Association occupying the platform the matter was brought up for the action of the members. Vice President Walter, who also is Chairman of the committee appointed by the association to plan the exhibit, with David Lindsay, Jr., and Norbert A. Considine, as his co-workers on the committee, went over the proposed plans of paper exhibits. In his report on the present status of the Sesqui-Centennial Exposition, with relation to the paper features, Vice President Walter stated that so far the American Pulp and Paper Association had taken no action towards co-operating with the Philadelphia Association in making its plans for the representation of that body or its members in the proposed paper making exploitation, although the matter was brought to its attention at the October Convention in Chicago when the project was laid before the board of directors of that National organization. The committee was urged by the local paper men to take the matter up again with the American Pulp and Paper Association when the board of directors meet in New York shortly after the New Year and to secure the interest of the paper makers of the country in providing exhibits of their products and other displays that will provide an informative and educational program of the progress of paper making in America and to solicit their speedy response so that the project may be gotten under way with the object of providing a comprehensive exploitation of the industry on a par with its importance in the commercial world.

Some Proposed Features

While entering upon this plan of providing entertaining and informative exhibits of the various paper making projects as they are conducted by the numerous manufacturers in this country, Vice President Walter placed before the local paper makers his plans for some of the features which the committee had proposed as likely exhibits and including the arrangements with the United States Bureau of Standards of Washington, D. C., to remove for the term of the exhibit its model paper making machine to the exposition headquarters in Philadelphia and to give daily demonstrations of paper making of the many grades of paper now on the market. This experimental machine could be operated either by the Government experts directly or by the various paper manufacturers throughout the country who might be able to furnish their own paper makers for the demonstrations. It is also proposed to have paper manufacturers feature their own processes of paper making with educational displays of the raw materials, their prep-



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THE VICKERY DOCTOR

aration for the pulp foundation of paper and the entire factors that enter into the manufacture of the various grades of writings, ledgers, bonds, books, coated, krafts and all other products that form the nucleus of the American industry. These exhibits will not only give the paper industry a splendid opportunity of bringing before the public the progress of paper making as it has been developed in America but also will be valuable as an advertising medium for individual brands and mills, each manufacturer being allowed to use his own name and follow his own schemes of exploitation with the co-operation of the committee and the Sesqui-Centennial Commission.

The local committee will, shortly after the first of the new year, take up the matter with the Sesqui-Centennial Commission and work out a practical plan for the extensive exploitation of paper making which rightfully should be an important proposition in this 150th anniversary celebration of American Freedom. It was here that the first paper mill in America was built and in this exhibit it is hoped that a reproduction of the old David Rittenhouse Mill, the first in America and still standing in the Wissahickon Drive along Fairmount Parkway, will be made one of the display features, showing the primitive means of hand paper making as contrasting with the modern process of elaborate machinery and expansive mills property devoted to this commercial enterprise and essential and fundamental unit of industry and commerce. When the plans are discussed with the Sesqui Commission it is proposed to outline the exhibit space, the type of displays and educational features, the number of attendants needed to carry out the project and means for stimulating the interest of the public. These plans will be laid before the board of directors of the American Pulp and Paper Association when they meet in New York after the first of January and they will be urged to interest the manufacturers in the proposed exhibit to some definite end. The local committee and association believe that this exposition offers the paper manufacturers one of the best opportunities afforded within recent years of placing before the public the importance of the industry, its progress towards one of the most extensive of the nation's commercial enterprises and gives excellent means for advertising the products of the individual mills as well as the industry as a whole. The Sesqui-Centennial Exposition is to be of international scope, all the leading European, South American and Oriental countries having already made plans or are now negotiating for exhibits during its advent.

Following the outlines of the plans of Vice President Walter and the Committee, President Morgan H. Thomas of the Philadelphia Paper Trade Association went over the ground briefly expressing his desires for earnest co-operation of the industry as a whole for making this exhibit a worthy representation of the nation's manufacturing, distribution and usage of paper as well as an outstanding feature of the Sesqui Exposition that will attract international interest and nationwide publicity to the American products. He expressed his hopes for securing the interests of the manufacturers particularly through the American Pulp and Paper Association's co-operation and urged the paper men to promote the cause by their efforts in behalf of the exhibit.

Riegel & Co. In Annual Celebration

With 30 members of the business family of Riegel & Co., Inc., 140 N. 6th street assembled at the festive board there was a general celebration of the closing of the year's accounts and a co-mingling in amity and good will of employer and employee last Saturday at the Rittenhouse Hotel. While the national festive bird graced the center of the dining table and the merrymakers partook of a generous helping of turkey and other good things, there was a brief address of welcome extended by Treasurer Arthur B. Sherrill, representing the firm as host to the workers, in which he gave a warm and hearty expression of the official family's appreciation of the efforts put forth throughout the year by those associated on the employment forces. Then with cleverness born of intimate association with his fellows, toast master R. L. McCall made the rounds of the business family with fun provoking quips of a personal appeal in the good wishes extended to each. Then followed a program of vocal and instrumental selections with "home talent" featured, among them being Treasurer Sherrill, in a solo, James McKeag, in a tenor ballad, W. Engle, F. Van Gilder, H. Beckman and R. L. McCall in a quartette rendition of "Memory Lane," and H. Beckman featured at the piano. On behalf of the business organization there was presented to Treasurer Sherrill, four prints of old Colonial scenes of Philadelphia. In the cleverly designed menu with its chimney opening there was slipped a "green back" Christmas memento of the firm. The banquet room was given a glowing touch of holiday cheerfulness in attractively garlanded Christmas colors. The committee under whose auspices the banquet was arranged was James McCracken, on the speakers list, and who summed up the year's business history, Roy L. McCall and F. Van Gilder, assistant treasurer Winfield Predmore told of the financial progress of the firm and thanked the workers for their earnestness in raising the totals of the sales, stressing the progress of the paper industry in the past year, noting the changing of sales promotion methods in these days of keen competition and stating the higher standards that are required for all grades of papers and the tendency of the industry to become a specialized affair.

Schulkill Paper Co. Awards Contest Prize

Following its contest among the printing industries for the suggestion of an appropriate name for its newest of papers the Schuylkill Paper Company, with offices in the Drexel Building, has announced the winner of the award of $25. There were more than fifty firms in the competition. The winner announced during the week was Charles C. Nahill, secretary of The Priestly Printers, 321 S. Juniper street, the name having been suggested as the "Triqual" which will be the title of the newest machine finish book papers manufactured especially for the Schuylkill Company and is to be stocked in all substances 40 pounds up and in various finishes. It is adapted for periodicals, magazines, books or other like uses. It is to become one of the standard makes of the firm. The selection of the title for the new brand was made by a Committee of members of the Typothetae including S. Clayton Wicks and Charles F. Kindt, Jr., co-operating with Frederic S. Balch of the Schuylkill Paper Company and his associate James Andrews, in a direct-by-mail campaign.

E. L. Kelly Attends K.V.P. Convention

A journey to the headquarters of the Kalamazoo Vegetable Parchment Company was made during the week by the local manager E. L. Kelly, who began his westward trip on Christmas Eve for the purpose of attending the convention of the sales organization to convene this week. There will be the annual gathering of the business family in a four day schedule of trade sessions interspersed with a social program in which the manufacturers will be host to the organization. During the convention there will be outlined the year's plans and announcement of developments proposed for the coming year. Manager Kelly will return to the local headquarters in the Drexel Building upon the close of the sales meetings.

Crown-Willamette Paper Co. Changes

[FROM OUR REGULAR CORRESPONDENT]

PORTLAND, Ore., December 24, 1925.—Roy O. Young has been transferred from mill manager for the Crown Willamette Paper Company's plant at West Linn, Ore., to the mill at Camas, Wash., due to the resignation of Walter Graves, recently manager of the latter plant.

John Hanny, of Ocean Falls, B. C., and formerly of Oregon City, has been appointed to succeed Mr. Young at West Linn.

Fred Simmons, who has held the position of assistant superintendent at the West Linn Mill, will go to Ocean Falls to fill the vacancy which occurred at that place when Mr. Hanny left.

Resolved for 1926

WASTE MUST STOP!

IN making your resolutions for the coming year, don't forget the bugbear —"waste"! Resolve to stop waste and you help to end one of the biggest evils in the paper industry.

Take the NEW BELOIT FOURDRINIER into partnership with you. It will do more than any other single factor at your command to stop waste, eliminate idle time, speed up production, increase economy and promote efficiency in the manufacturing end of your business.

Now is a good time to use your reserve fund—to modernize your plant and make good on this resolution!

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Since 1858 Builders of Paper, Board Mill and Container Plant Machinery

Paper and Allied Mills Busy in Fox River Valley

American Tablet and Stationery Co. Makes Plans for Expansion at Green Bay—Kimberly-Clark Co. Make Good Progress in Expanding Cellucotton Plant at Niagara Falls—Interest Grows in Problems of Stream Pollution

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., December 28, 1925.—Officers of the American Tablet and Stationery Company, at 600 North Webster street, Green Bay, Wis., are making plans for the rearrangement of the machinery in the plant, an addition of new machines and subsequent additions to the force to increase the output of the company.

The company was recently reorganized and is now affiliated with two other tablet companies, the Western Tablet Company, at St. Joseph, Mo., and the Miami Tablet Company, at West Carrollton, Ohio, a fact which, it is believed, will add considerably to the business handled through this plant.

Officers recently elected for the Green Bay Company are: W. Albrecht, St. Joseph, Mo., president; W. W. Sunderland, West Carrollton, Ohio, vice president; W. J. Bertrand, Green Bay, secretary; B. L. Parker, Green Bay, assistant secretary, and M. Forberg, Green Bay, treasurer.

Mr. Albrecht is president of the Western Tablet Company, St. Joseph, Mo., said to be the largest tablet manufacturing company in the world, and is also president of the Miami Tablet Company of West Carrollton, Ohio. The reorganization of the plant is now under way, and it is expected that the force will be increased to approximately fifty persons about the middle of February and, if the hopes of the future are realized, the force will reach one hundred or possibly 150 next June, it is said.

Mr. Forberg, who was sales manager for the American Tablet Company before its reorganization as the American Tablet and Stationery Company, is in charge of the plant as general manager. Mr. Forberg announced that no labor will be imported, as it is the plan of the company to hire all the help needed in Green Bay. Also as practically all of the materials needed in the production of paper tablets and stationery are available in the Fox River Valley, it will be unnecessary to go outside of this territory for the materials needed.

In view of the fact that paper products can be shipped from Green Bay to Chicago or Minneapolis cheaper than from St. Joseph or from West Carrollton, it is not unlikely that considerable business from these plants will be diverted to the Green Bay plant. If that plan works out successfully, the force at the Fox River Valley city will be considerably increased, it is said.

Kimberly-Clark Expand Cellucotton Mill

Considerable progress is reported by the Kimberly-Clark Company, of Neenah, Wis., in the expansion at the Cellucotton Products mill at Niagara Falls. The first machine was started on November 17, 1924, but was not running full time until November 29, when six machines ran their first full day. At that time the mill required about thirty girls for six machines. Of those thirty girls, fifteen are still with the company. Since then the plant has increased its force from thirty to about ninety, and is equipped to take care of one hundred and eight girls.

Problems of Stream Pollution

Perceiving that if the problems of stream pollution are to be solved, they must be solved jointly by the various states interested in them, W. L. Stephenson, chief sanitary engineer of Pennsylvania, called a conference of representatives of various states last week in Harrisburg. The Wisconsin delegates were Vance P. Edwards, of Appleton, identified with the Forest Products Laboratory at Madison, and C. M. Baker, Madison, state sanitary engineer.

The purpose of the conference, according to Adolph Kanneberg, member of the Wisconsin Railroad Commission, was to coordinate the efforts of authorities in the different states interested in the problem of stream pollution by paper mills. If the various states would agree upon a uniform law for the treatment of sulphite liquor that is said to form much of the pollution, manufacturers could put the measures necessary to remedy the situation into effect on an equal basis without manufacturers of one state having an advantage over those of another, Mr. Kanneberg said, even if the remedial measures were not economical.

The Wisconsin commissioner is confident that a solution will be found for the problem. It is largely a matter of research, he said, in which paper manufacturers would be ready to join. The remedy would probably come in the form of an evaporation process to be worked out in research laboratories, Mr. Kanneberg said.

New Bridge for Telulah Paper Mill

The Telulah paper mill of the Fox River Paper Company, of Appleton, is receiving a new bridge for its tailrace, as the result of the decision of city authorities to move the iron bridge from the tailrace of the Appleton Machine Company to the paper mill and to replace that structure with a smaller bridge of concrete. A wooden bridge at the Telulah mill tailrace, which is closed to traffic, will be removed.

The concrete bridge at the Appleton Machine Company, which is now completed, was erected beside the iron bridge so as not to block traffic during the course of construction. The iron structure is about to be moved on rolls in sections to its new site. Substantial piers will be built to support the bridge.

Relocation of the bridge will give the Fox River Paper Company additional fire protection and also will furnish the workmen of the Telulah mill a shorter cut to the Lawe street bridge across the Fox River.

Estate of J. H. Delbridge

An estate estimated at slightly more than $100,000 was left by the late James H. Delbridge, president of the Marinette and Menominee Paper Company, Marinette, and the Falls Manufacturing Company, of Oconto Falls, it was brought out when the will was filed for probate recently. Mrs. Delbridge is named executrix and sole beneficiary. Lehner and Lehner, Oconto attorneys, represent the petitioner in the proceedings. The estate is said to consist of $98,500 in personal property and $1,150 in real estate outside of the homestead.

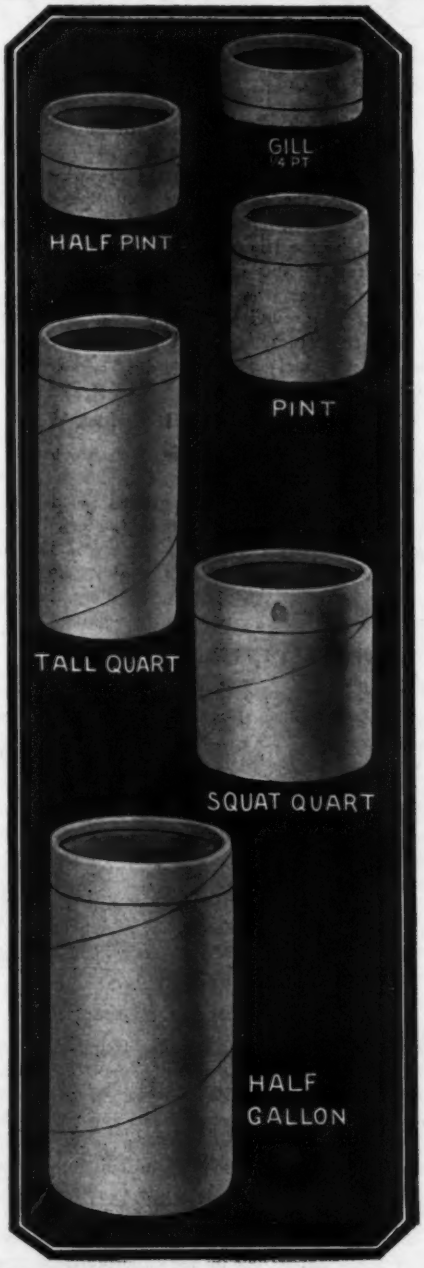
Fire at Paper Roll Co. Plant

Fire last week threatened the plant of the Paper Roll Company, of Menasha. The blaze started at about two o'clock in the morning in a dry kiln. It was noticed by the night watchman, who summoned the fire department. The fire was difficult to check on account of the metal sheeting, but firemen managed to extinguish it before it had a chance to do much damage.

Power Line for Paper Companies

The city council of Wisconsin Rapids has given approval to the petitions of the Consolidate Water Power and Paper Company and the Nekoosa-Edwards Paper Company of that city for the erection of a high power line through Wisconsin Rapids and joining the two plants. This will be the last link in the chain connecting power plants along the Wisconsin River from Rhine-

(*Continued on page 68*)



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Ice Cream
Ice Cream Sodas
Sundaes
Orange Juice
Hot Chocolate
Hot Coffee
Soup
Raw Oysters
Clams
And Other Sea Foods
Cottage Cheese
Cream
Milk
Buttermilk
Salads
Pickles
Jams and Jellies
Peanut Butter
Sauer Kraut and other Delicatessen Products
Maple Syrup
Maple Sugar
Candy
Fruits, Etc.
Hamburger
Sausage

Used by Retail Stores for

Bird Seed
Bird Gravel
Flower Seed
Naphthalene Flakes
Dry Drugs, Etc.

Used on Tag Days for Collecting Money for the Salvation Army, Churches and Charitable Organizations

Distributed by JOBBERS

Toronto Looks Forward to Improved Demand

Trade Expected to Be Steadier During the Year Just About to Open Than It Has Been During the Past Twelve Months—Nipigon Corporation Expected to Build News Print Mill of 200 Ton Capacity—Thunder Bay Company to Expand Plant

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., December 28, 1925.—Not a great deal of business is being done around the paper houses just now as most of the time in the week between Christmas and New Year's is being devoted to staff conferences, reunions, selling plans for the coming year and extending holiday greetings. Practically all the paper firms in the city closed from Thursday afternoon until today, thus allowing the members of their sales and warehouse forces to enjoy a long week end.

On the whole, business was very fair during 1925. It was spasmodic at times and some months showed a drop from last year, but in the aggregate it is likely that the showing will be much better than expected, when accounts are all collected, trial balances struck and inventories completed. Prices were in the main steady and this had a conservative effect on buying and distribution.

The feeling is very hopeful that trade will be steadier during the coming year than it has been in the past. There were very few financial fatalities in the paper jobbing line and while collections were at times slow and credits had to be closely watched and orders more eagerly and persistently gone after, the trade has come through the period of 1925 in far better shape than many allied industries. This has been largely brought about by the splendid work of the trade associations, manufacturers, jobbing and paper box branches, and the cooperation and harmony existing between the producers and distributors in the matter of mutual arrangements and better trade customs and practices.

Will Not Do Warehousing in East

The rumor that the Provincial Paper Mills, which are organizing a subsidiary organization known as Provincial Paper Sales, Limited, with a capital of a million dollars, and will operate the warehouses of the John Martin Paper Company at Winnipeg, Calgary and Edmonton, recently acquired, and intend to extend activities in a similar line in Eastern Canada, is denied by President I. H. Weldon, who states there is no truth in the report. He declared that he was at a loss to understand how the rumor originated. So far as the East was concerned he said that the company would continue as they had done for years and confine their energies to the manufacturing end. The company has enjoyed a good year and at the annual meeting, which will be held in a few weeks, it is expected that a very satisfactory report on operations during 1925 will be presented to the shareholders.

Detroit Company Bought Much Wood

The Detroit Sulphite Pulp and Paper Company, of Detroit, which maintains an office and yard in Fort William, Ont., paid out to the farmers in the Thunder Bay district during the year just closed some $300,000 for pulpwood. The wood is shipped from the head of the Great Lakes to be manufactured into high grade paper, most of it being converted into fine tissues. Walter Launbengayer is the local manager of the company at Fort William, where they have twenty acres of ground, which is used for storage purposes and is capable of accommodating fifty thousand cords of pulpwood. The yard is equipped with an electric loader, which can load wood into boats and barges at the rate of four hundred and fifty cords a day. The pulpwood purchased is shipped to Detroit in the fleet of barges and steamers belonging to the Detroit Sulphite Pulp and Paper Company.

Will Spend Million Dollars Buying Wood

The Hammermill Paper Company, of Erie, Pa., of which Malcolm Cochran, Fort William, Ont., is manager of the pulpwood operations of the firm, exported in 1924 from the head of the Great Lakes to the plant at Erie sixty-two thousand cords of pulpwood. In 1925, the company bought more than eighty thousand cords from settlers, farmers and subcontractors at an expenditure of $750,000. In 1926, the Hammermill Paper Company proposed to spend $1,000,000 in the Thunder Bay district. The cutting is done in the winter time by farmers and settlers and the pulpwood from the district stands in high favor with the officials of the company at Erie.

Nipigon Corporation Will Erect Mill

A paper mill with a capacity of two hundred tons of news print daily, together with the necessary extensions which go to make up large, modern ground wood and sulphite pulp mills, will be developed by the Nipigon Corporation, of Nipigon, Ont., just as soon as the promised timber limits are signed and contracted for. The mill was built in 1921 and started operations in the winter of the same year, the plant being controlled by the Nipigon Fiber and Paper Mills. It went into liquidation and was sold in September, 1923, to the Nipigon Corporation. Operations were recommenced a few months later and the plant, which was thoroughly overhauled, has been running ever since. The output is fifty tons daily of ground wood pulp and the wood supply is obtained from sub-contractors and settlers. The expenditures on this mill, when the final enlargements are arranged for, will run into millions of dollars.

Great Lakes Company Has Much Wood

Recent advices from Fort William, Ont, are to the effect that the plant of the Great Lakes Paper Company, which now turns out one hundred and fifty tons of ground wood pulp daily, and has been in continuous operation since it started in June, 1924, now employs two hundred and thirty-five men. The company has in pile at the present time some thirty thousand cords of pulpwood. An early announcement is expected regarding the erection of a news print mill with the latest type of machines.

Thunder Bay Company Will Extend

Three years ago the plant of the Kaministiquia Pulp and Paper Company at Fort William, Ont., was purchased by the Thunder Bay Paper Company. It was then turning out thirty tons of ground wood pulp daily, which capacity has since been increased to one hundred and twenty-five tons. Horse power to the extent of eight thousand five hundred is used and, within three years, the company expects to be using twenty thousand horsepower. The company will install in the near future a news print machine of about ninety tons daily capacity, which will be ready for operation by the summer of 1927. Wood pulp and sulphite facilities will also be extended. The company is asking for a fixed assessment from the city, which the ratepayers will be asked to ratify at the January municipal elections.

Want No Embargo Or Export Tax

As a result of the agitation for the placing of an embargo on the export of pulp wood from private lands, a movement is now under way in the Thunder Bay district of Ontario to organize the farmers who have holdings of wood and settlers who depend largely upon the sale of pulp wood for export. An office has been opened in the Graham and Horne building in Fort William for the purpose of advancing the cause of the settlers in connection with the pulpwood business and to carry on work deemed helpful in opposing such efforts as may be made to impose an embargo or heavy export tax on the exportation of raw pulpwood.

BLEACHED and UNBLEACHED
SULPHITES
KRAFT PULPS
GROUND WOOD
NORRONA
PULP STONES

PERKINS-GOODWIN CO.
33 WEST 42nd STREET
NEW YORK

PAPER
PRINTING PAPER
of
EVERY DESCRIPTION

Obituary

Charles Wollny

Charles Wollny, president of Wollny & Co., dealers in paper and twine, at 859 Cypress avenue, Woodhaven, was killed Monday of last week when a Long Island express train travelling at fifty miles struck his automobile at the Eighty-seventh street crossing at Woodhaven.

The automobile was hurled fifty feet and was immediately enveloped in flames. Scores of persons standing near the crossing rushed toward the burning automobile, but it was not until firemen arrived that the flames were extinguished.

The train of eight cars was an express bound to Jamaica from Flatbush avenue, Brooklyn. It travelled more than two hundred feet before the motorman brought it to a standstill.

Mr. Wollny had for a long time been a member of the Metropolitan Bag and Paper Jobbers' Association, by which organization his loss will be greatly felt.

Roderick Beebe

Roderick Beebe, whose death occurred on December 21, at the early age of twenty-four, was fourth in direct line of a family engaged in the paper and pulp business. His great grandfather, for whom he was named, was born in 1816, and a line of worthy sires extended back to John Beebe, who immigrated to this country from England in 1650. The young man was rapidly getting into the activities of the trade. He was of a peculiarly attractive personality and well liked everywhere for his engaging ways and clean life. He leaves a young wife and child of two years of age, who bears also the honored name of Roderick.

Consolidated Paper Co. Gives Bonuses

MONROE, Mich., December 29, 1925.—Over thirty five thousand dollars in earned bonuses is now being distributed to Consolidated Paper Company employees. Also the company has purchased group life insurance policies aggregating about two million dollars for the employees.

The amounts of these policies range from five hundred dollars for those employed less than one year increasing two hundred fifty dollars for each year of service until a maximum of two thousand dollars is reached.

All employees who have been with the company six years receive the two thousand dollar policy. Nearly twenty percent of the employees already qualify for the maximum amount. The policy also provides that in event the individual is totally disabled from any cause whatever the amount of the policy is paid to the individual.

These policies remain in effect and all premiums are paid by the company as long as the individual remains in their employ.

This insurance was underwritten by the Connecticut General Life Insurance Company of Hartford, Conn., Albert E. Buss, agent for the company in this territory, negotiated the purchase.

I. P. Mill at Glens Falls Being Overhauled

[FROM OUR REGULAR CORRESPONDENT]

GLENS FALLS, December 28, 1925.—The Glens Falls mill of the International Paper Company is being overhauled and modernized to allow the plant to manufacture a higher grade of paper than produced heretofore. Alterations in the machines, addition of improved machinery in all departments, and other charges to bring the plant up to modern specifications for making a high grade of news stock are now under way and when these are completed it is stated that the local mill will be in full operation and will maintain this schedule indefinitely. Recent contracts made by the company requiring a higher grade of news will provide plenty of work for the local mill, it is stated. The special product will enable the mill to be relieved from the competition of the regular news print mills of Canada, and the amount of stock required is such that the continuous operation of the Glens Falls plant is assured.

This announcement means an end to the rumors that the Glens Falls mill would be allowed to stand idle because of its being a "high cost" regular news mill, or that it might be turned into a power plant in line with the International Paper Company's plans for reconditioning some of its obsolete mills in New York State for the development of hydro-electricity: The payroll of the Glens Falls plant will be greatly increased when operations are resumed following completion of improvements now under way.

Boston Paper Demand Satisfactory

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., December 28, 1925.—The past week saw no eventful change in the paper trade here. Practically all branches of the business have shared in the steady volume of business that this section has enjoyed for some time. It is freely predicted in all quarters here that the year will close with a generous lead over 1924 marks. There is also a noticeable atmosphere of optimism concerning the coming year.

The trade feels that conditions are becoming more stabilized. This is evident, certain dealers say, by the willingness on the part of some of the big customers to renew contract discussion. It is pointed out that while contracts, in certain lines, have been avoided for some time past there now is a growing tendency to return to them.

The past week has been a busy one both for fine and coarse grades. The holiday trade proved to be all that Boston had hoped for. The demand was steady and the orders generous. Intensive drives are now being focused upon new business—that is business for the new year. There were no price changes but some talk was heard concerning a possible break in the price of kraft. The demand for this paper has been unusually heavy, reports show and the past week saw little let-up.

The paper box men, while the business was slow in coming, say they shared in the eleventh hour rush for holiday goods. They have some new year business booked already.

The raw stock division is quiet and of course roofings now have fallen off, though they have enjoyed an unusual run of fall business, due to extraordinary weather.

Story of the Beveridge Paper Co.

The Beveridge Paper Company of Indianapolis, is sending out to the trade an illustrated booklet, "The Story of Beveridge." In the booklet are reproductions of original drawings made by the noted artist, Frederick Polley. The reproductions show views of the large No. 1 machine, the west or river side of the mill and a front office view showing the large park in the foreground. The booklet describes in detail the various stages through which the mill has passed since it was first started in Civil War times, as a Fourdrinier machine mill making news print from all rag stock.

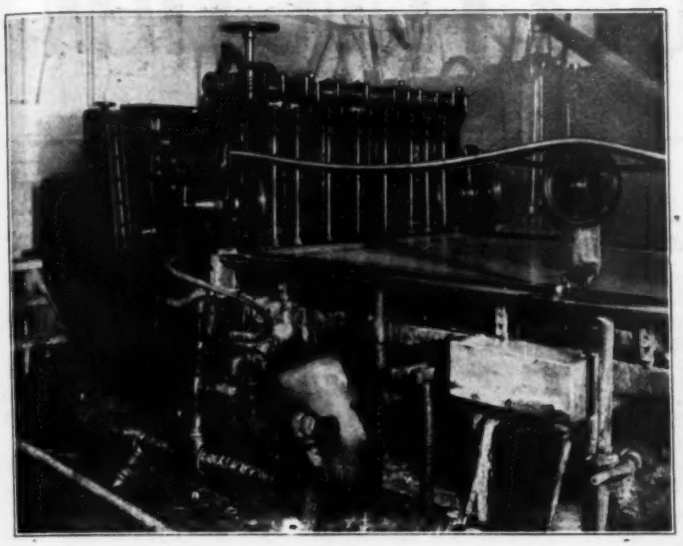
Dr. Bovard Returns From Australia

Dr. William M. Bovard, formerly technical director of Package Paper and Supply Company, Springfield, Mass., has just returned to United States after having spent the past two and a half years in Melbourne, Australia, where he was associated with MacRobertson's, establishing a plant to manufacture waxed paper of all kinds.

Parsons Paper Co. Employees Get Gold Pieces

[FROM OUR REGULAR CORRESPONDENT]

HOLYOKE, Mass., December 28, 1925.—Employees of the Parsons Paper Company were given gold pieces for Christmas presents last week, the men employees receiving each a $10 gold piece and the women employees each a $5 gold piece. The heads of departments received a little more.



The Trade Puts *the* Stamp *of* Approval *on the* Voith Inlet

During the past year over fifty representative manufacturers installed Voith High Pressure Stock Inlets. The products of these concerns include a wide variety of papers, ranging from tissue to bristol. In these installations the quality of their paper has been improved and production costs materially lowered.

Not only the fact that over 100 Voith Inlets are in use proves that the trade has placed its stamp of approval on this remarkable machine. Every installation means more orders depending on the number of paper machines in the mill and these repeat orders that continually come in demonstrates it conclusively.

We have ready for you an attractive booklet giving full particulars regarding the Voith Inlet. Write for your copy today.

SOME of the USERS of the VOITH INLET

Kimberly-Clark Company	9
Hammermill Paper Company	5
Menasha Printing & Carton Co.	3
Marathon Paper Mills Co.	3
Mead Pulp & Paper Company	6
Northwest Paper Company	4
Howard Paper Company	2
Champion Coated Paper Co.	3
Lakeview Paper Company	2
Hammersley Manufacturing Co.	2
Nekoosa-Edwards Paper Co.	3
Eastern Manufacturing Co.	2
Rhinelander Paper Company	3
Warren Manufacturing Co.	6
Bergstrom Paper Company	2
Brown Company	2
Cliff Paper Company	2
Itasca Paper Company	2
Minnesota & Ontario Paper Co.	4

VALLEY IRON WORKS CO.

APPLETON, WISCONSIN

New York Office: 350 Madison Avenue

CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Finances and Operation of Paper Mills

Dayton, Ohio—The Aetna Paper Company, manufacturer of water-marked papers for Government service, has acquired two mill buildings on Franklin avenue and has tentative plans under way for remodeling and enlarging for plant expansion. It is purposed to erect one or more one-story additions and purchase considerable new machinery. The entire project will cost in excess of $1,000,000, including equipment. Maxwell Howard is president.

Norton, Mass.—The Sweet Paper Box Company has preliminary plans under consideration for the rebuilding of the portion of its plant recently destroyed by fire with loss reported at close to $50,000, including machinery. The reconstruction will cost close to a like amount.

Morgan City, La.—The Dixie Pulp and Paper Company, care of E. I. McIlhenny, New Orleans, La., president, recently formed under Delaware laws with a capital of $15,000,000, is reported to be considering plans for the construction of a new mill in the vicinity of Morgan City, for the production of pulp and paper from local grasses. As now projected, the plant will consist of a number of buildings, with power house, machine shop and auxiliary structures, estimated to cost more than $1,000,000, with equipment.

Pottsville, Pa.—The Pottsville Paper Box Company, recently organized by W. J. Biever, Pottsville, and associates, has acquired the local plant of Robert R. Morrison, manufacturer of paper containers and packages and will take possession at an early date. The new owner plans for extensions and improvements in the present factory, including the installation of additional equipment.

Cincinnati, Ohio.—The Bishopic Manufacturing Company, Spring Grove avenue, has filed plans for the erection of its proposed new addition for the production of wallboard products, and will proceed with the work at an early date. It will be two and three-story, 63 x 120 feet, estimated to cost about $55,000. Benjamin De Camp, Gerke Building, is architect.

Seattle, Wash.—Charles C. Moore & Co., L. C. Smith Building, engineers, will carry out an installation in a new power plant to be constructed at the mill of the Powell River Company, Powell River, B. C., including boilers, stokers, conveying apparatus, etc., reported to cost in excess of $50,000. Work will be placed in progress at an early date.

Elizabeth, La.—The Calcasieu Sulphate Paper Company has broken ground for a one-story addition to its local paper mill and will handle superstructure by day labor, under the supervision of J. E. Ryberg, construction engineer. The new mill will be devoted to the production of kraft papers and is estimated to cost approximately $250,000, including machinery.

Grand Rapids, Mich.—The Brown-Graff Paper Company is said to be planning the early rebuilding of the portion of its storage and distributing plant destroyed by fire, Dec. 14, with loss reported at $23,000.

Philadelphia, Pa.—The State Paper Box Company, 3rd and Cumberland streets, has leased a floor in the building at 1027-29 North Front Street, and will use for expansion in its plant. It is said that equipment will be installed at an early date.

Middletown, Ohio.—The former local paper mill of the Tytus-Gardner Company, Main street, has been taken over by new interests and will be remodeled and improved for another branch of business. Paper production will be discontinued.

Dayton, Ohio.—The Specialties Paper Company, Miami Chapel Road, has work under way on a new one-story addition at its plant, reported to cost about $20,000, for which a general contract recently was awarded to the Dayton Fabricated Steel Company, Dayton. It is expected to have the structure ready for occupancy at an early date.

Montreal, Que.—The Anglo-Canadian Pulp and Paper Company is perfecting plans for the construction of its proposed news print mill on the St. Charles River, vicinity of Manicougan, and plans to begin actual work early in the spring. The plant will consist of a group of buildings, with power station, machine shop and other general mechanical structures, estimated to cost close to $14,000,000. The plant will be of thoroughly modern type, with fumes controlled by a new device. The company recently acquired an extensive tract of timber lands on the North Shore, near Manicougan, and will develop this property as a source of raw material, including logging facilities, saw mills, etc.

New Companies

North Tonawanda, N. Y.—The Tonawanda Corrugated Box Company has been incorporated with a capital of $50,000, to manufacture corrugated paper containers and packages. The incorporators are E. C. and B. C. Metzloff, and R. O. Neubecker. The company is represented by Love & Keating, Ellicott Square, Buffalo, N. Y.

Irvington, N. J.—The Standard Paper Products Company, Inc., has been incorporated with a capital of $50,000, to manufacture paper goods. The incorporators are Harold F Cunningham Joseph J. Dunn and Grenville G. Abernethy, 490 Chancellor avenue, Irvington. The last noted is company representative.

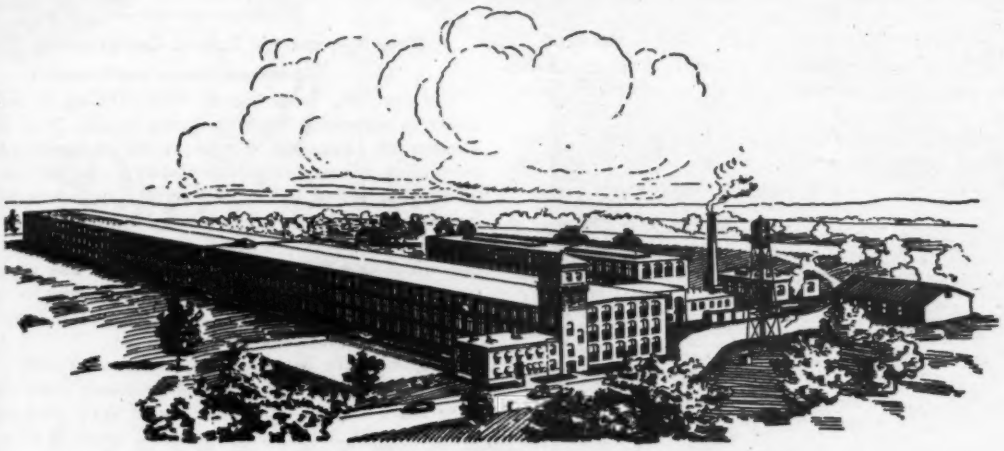
Chicago, Ill.—The Murray Paper Products Corporation, 4201 Belmont avenue, has been incorporated with a capital of $20,000, to manufacture and deal in paper goods. The incorporators are Richard P. and Harry R. Murray, and Merrill J. Clark.

Brooklyn, N. Y.—The Hamilton Waste Paper Company has been incorporated with a capital of $25,000, to deal in paper waste, etc. The incorporators are A. B. and H. G. Enovse. The company is represented by F. A. Margiotta, 50 Court street, Brooklyn, attorney.

Philadelphia, Pa.—The Richie-Howarth Paper Company is being organized by Anthony Richie and John R. Howarth to deal in paper products. Application for a state charter will be made on Jan. 11. The company is represented by George W. Harkins, Jr., Land Title Building, Philadelphia.

New York, N. Y.—The Artcraft Box Company has been incorporated with a capital of $50,000, to manufacture paper boxes and containers. The incorporators are A. Meyer, J. and I. E.

(*Continued on page 66*)



Albany Felt Company's Works

STRAWBOARDS

One of the big branches of the paper industry, particularly in the United States and Japan, is in the manufacture of strawboards.

The successful felt for this work must be made from strong, serviceable wools in a weave open enough to retain its filtering and water-shedding qualities for a maximum period.

Our Strawboard Felts are the result of endless attention to details. They are developed with care and precision. We are proud of the reputation they enjoy.

To any Strawboard Mills not now using Albany Felts we will be glad to submit samples of our various designs and do what we can to be of service.

ALBANY FELT COMPANY

Head Office and Works

Albany, N. Y., U. S. A.

FOREIGN REPRESENTATIVES

For the British Isles
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126 Queen Victoria Street,
London, E. C. 4, England.

For Japan
CHIYODAGUMI, LTD.,
Marunouchi Building,
Tokyo, Japan.

For Norway, Sweden and Finland
HVISTENDAHL & WERRING, LTD.,
Oslo, Norway.

For Brazil
FRANK M. GARCIA,
Caixa Postal No. 1801,
Rio de Janeiro, Brazil, S. A.

New York Trade Jottings

Richardson Brothers, paper and twine dealers, of 8 Beach street, New York, announce that Joseph Boak, Jr., will be admitted to partnership in their organization, January 1, 1926.

* * *

G. A. Ware, of the News Print Service Bureau, 342 Madison Avenue, New York, has returned from Canada after inspecting some of the principal paper mills over the border.

* * *

O. H. Castberg, of Oslo, Norway, Scandinavian representative for Atterbury Brothers, Inc., of 145 Nassau street, New York, is visiting headquarters to confer with his associates.

* * *

W. G. MacNaughton, secretary of the Technical Association of the Pulp and Paper Industry, has returned to New York after spending the Christmas holidays in Canada.

* * *

Colonel W. E. Haskell, late vice-president of the International Paper Company, is motoring down to Florida, where he plans to spend several months in furthering his private interests in the Sunny South. He is accompanied by his wife.

* * *

William A. Gateley, of the Simplified Practice Division of the Department of Commerce, visited several of his friends in the New York paper trade early this week. Mr. Gateley is severing his connection from the Department of Commerce today, December 31, to undertake special work for the Merchant's Association of New York.

* * *

The Electro Bleaching Gas Company announces the promotion of William J. Weed to the position of assistant manager of sales of that organization. Mr. Weed has been a member of the Electro Bleaching Gas Company staff and its associate company, Niagara Alkali Company, for the past thirteen years. His broad general background equips him admirably for his new role, especially because of the six years which have been devoted almost entirely to the pulp and paper field, in which industry he is widely and favorably known.

Wayagamack's Improved Position

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 28, 1925.—The financial statement of Wayagamack Pulp and Paper Company for the year ending November 30, 1925, just issued to shareholders, is unusually favorable and shows net earnings available for capital stock of $560,915, as compared with $89,013 last year, representing 11.2 per cent earned, as against 1.7 per cent. The earnings after income taxes, amounted to $1,189,268, compared with $677,509 last year, showing an increase of over $511,000. The improvement in the earnings of the company has been due to a marked change in the sulphate pulp and wrapping paper industries with better prices and a better demand for the company's output. As no dividends were paid on the capital stock of $5,000,000 during the past year, the amount available for dividend of $560,915 thus goes forward as an addition to the profit and loss surplus, which stood at $1,981,964, as compared with $1,197,292 on November 30, 1924. Great hopes are entertained of a still further improvement due to the fact that the company's news print plant has just come into operation.

Crown-Willamette to Plant Trees

[FROM OUR REGULAR CORRESPONDENT]

PORTLAND, Ore., December 28, 1925.—The Crown-Willamette Paper Company will plant at once a third of a million young coniferous trees in the upper Young's River Valley. This is the second year of a reforestration program sponsored by this company in Oregon. Last year several thousand trees were planted.

While some trees will be removed from the forest and planted on the tract this year, 300,000 young trees grown at the company's conifer nursery at West Linn, Oregon, will be taken to Astoria for planting in the denuded section.

J. H. Walker, property superintendent of the company, says that 7,000 trees to the acre is about the proportion producing best results.

New System for Sale of Government Timber

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., December 28, 1925.—Having in view the desirability of preserving Ontario's forest wealth, Hon. James Lyons, Minister of Lands and Forests in the Ferguson government, is introducing a new system with respect to the sale of government timber. The system, which will be first applied to the big timber contracts which are to be let in the Nipigon district, calls for the signing of contracts which will specify that all timber, not merely that which is merchantable, must be cut. The government also reserves the right to compel the burning of slash by operators and this will be enforced in the neighborhood of railway tracks, thus mitigating the possibility of fires.

In regard to the Nipigon limits, it is also specified that construction on the big developments, which include large saw mills and paper mills, must be commenced within thirty days of the signing of the contract, and must be completed within four years.

Tremendous reduction in Forest fires in Ontario is another feature of Ferguson government forest administration which is revealed in the tabulated results of the past seven years, which have been compiled by Mr. Lyons. This year the area destroyed by forest fires in the province was 10,400 acres; last year it was 14,000 acres, while for the five preceding years it averaged the appalling figure of 1,000,000 acres each year. This tremendous decrease in area destroyed is due largely to the efficiency of the air patrol system, which has successfully combatted fires in their incipient stages.

I. P. Has Bought No New York World Mills

"Denial of a report that purchase of the Degrasse Paper Company of Pyrites by the International Paper Company was made by officers of the Degrasse concern in New York, from information received here," says a press dispatch from Canton, N. Y. "The contradiction carried further word that there are no present prospects of the paper mill being sold or closed.

"This development removes the uncertainty that has existed since publication of the report as to future operation of the mill. The 300 men employed there were expected to be thrown out of work, in the event of the sale, as the International company was reported as planning to close the plant and junk the machinery. The Degrasse Company will continue to operate on the present capacity schedule.

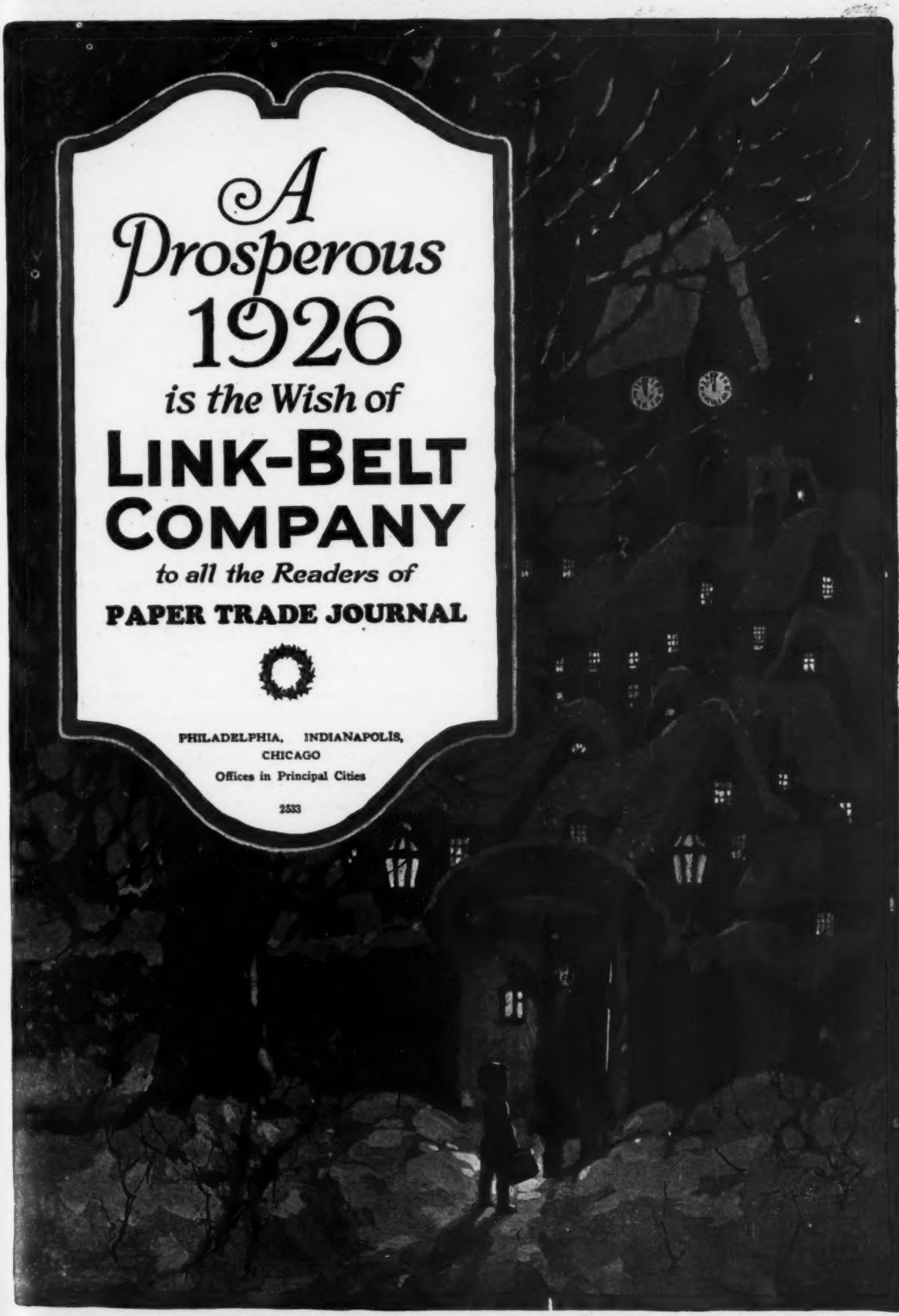
"Persons acquainted with the mill situation admitted that the International company had offered to buy the place in the past. The proposed deal had been refused, because the price offered was not considered enough. The basis of the current report of the sale was not known, although one explanation was that it may have arisen from sale of a block of stock by a minor stockholder."

When seen by a representative of the PAPER TRADE JOURNAL A. R. Graustein, president said that the International Paper Company had bought none of the mills of the *New York World*.

Algonquin Paper Mill Improvements

A special insulated paper machine hood is being installed by H. S. Taylor, consulting engineer, of Dayton, Ohio, over the 204-inch news machine at the mill of the Algonquin Paper Corporation, at Ogdensburg, New York.

The J. O. Ross Engineering Corporation, of 32 East 42nd street, New York, is also installing a heating and ventilating system for the machine, utilizing Briner economizers.


A Prosperous 1926
is the Wish of
LINK-BELT COMPANY
to all the Readers of
PAPER TRADE JOURNAL
PHILADELPHIA, INDIANAPOLIS, CHICAGO
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2533

PAPER TRADE JOURNAL
ESTABLISHED 1872

With Which Is Combined

PAPER
The Magazine of the Paper Industry

HENRY J. BERGER, Editor

Member A. B. C. Audit Bureau of Circulations

Vol. LXXXI New York, December 31, 1925 No. 27

RESEARCH AND DEVELOPMENT WORK

The editorial in the PAPER TRADE JOURNAL of December 3, against government intrusion has influenced Mr. D. Manson Sutherland, Jr., a member of the Technical Association of the Pulp and Paper Industry to write that he believes that attention has been directed in this article to a matter that is of vital interest to business men, particularly to manufacturers.

Mr. Sutherland has, for some years past, endeavored to keep in touch with Government activities in business which, in his judgment, are beneficial and he makes some observations in his communication which are particularly interesting and timely, regarding the benefits derived by cooperation between business and the Division of Simplified Practice of the Department of Commerce.

"One of the most contributing factors in the success of our industries and commerce," says Mr. Sutherland, "is the development of new processes and products, and the pulp, paper, and paper board industry has not lagged in this respect. It is equally true that the foresight and financial support of our capitalists have enabled many independent inventors and organized research and development departments to perfect their ideas and attain commercial success.

"In business enterprises, it is possible to know the cost of all the factors involved and demonstrate by profit or loss, the results attained, and if research and development work happens to be one of the factors, then it can be determined, but how is it analyzed, and what conclusions can be drawn for future guidance by executives responsible for the enterprise as a whole?

"Practically every item of cost entering into the books of account of a company relates to business already transacted, but research and development expense represents money expended upon which there is rarely a quick return and sometimes never.

"Every executive of manufacturing plants is constantly questioning and debating the expense of his research and development department, and extremes of opinion are shown by the poor equipment and personnel in some mills, and almost extravagant buildings, equipment and personnel in others. Is it not a general truth that successful companies maintain the latter type?

"It is not my intention to discuss cost details, but to call attention to the need for increased efficiency in research and development departments, large or small, and in the efforts of individual investigators and inventors.

"Most students of efficiency have been amazed at the statistics of the Department of Commerce, Division of Simplified Practice, which has investigated industry after industry, and found hundreds of different sizes and kinds of products which could be eliminated with benefit to the industry and the Public at large. Such splendid results have only been possible by cooperation between trade associations and the Department as secrecy and personal egotism in most enterprises have delayed progress so beneficial to all.

"It is not my desire to advocate control of business by Government agencies, but when abuses are found which are against the public welfare, I know of no other agency powerful enough to correct them, and in the matter referred to, it is obvious that the Department acted only as counsellor and referee without force of any kind except public opinion.

"Secrecy and personal egotism on the part of executives high and low, still and, no doubt, will always prevail, and in no department of business is it more prevalent than in research and development, and yet every man engaged in this work without exception has at some time or other developed an "original" idea, which he ultimately discovers was published in text books or patent literature before he was born, and many departments have duplicated work completed before they were organized.

"Such duplication of effort would arouse the ire of business administrators if it existed in any production departments under their care and when it is recognized that every industry has this burden, the annual bill is colossal.

"Experience is a wonderful teacher, but expensive when given to a student incapable of absorbing and utilizing the knowledge to the benefit of an industry and mankind. It is tantamount to a crime for any individual or organization to attempt Research and Development Work without taking advantage of the lessons that experience alone can teach, but it is done every day.

"The time has not yet come for any government agency to organize efficiency in research work and there will be no demand for such cooperation until the individual realizes that his span of Life is too short to absorb and efficiently use past experience singly or in small groups, or executives in control of finances demand greater efficiency, and less duplication from their research Year Slogan be "Efficiency first in the Efficiency Department i. e.

"In the meantime, a large amount of money and time can be saved by utilizing the knowledge and experience of independent organizations and individuals who have made a lifetime study of research and development problems. Most, if not all manufacturing concerns would make large annual savings by employing outside unbiased research and development agencies, so let the New Year Slogan be "Efficiency first in the Efficiency Department i. e. Research and Development."

PROGRESS IN REFORESTATION

Reforestation has come to signify in popular acceptance whatever looks toward the establishment of a new timber crop, whether by natural reproduction from the old stand or by tree planting, and whether the new crop succeeds the harvested one or restores tree growth on deforested and idle land, says Secretary of Agriculture Jardine in his annual report to the President. In this

broad sense reforestation has made great progress during the past year.

Timber growing on the vast area—about one-fourth of the total land surface of the United States—better adapted to this than to any other form of use, is bound to come in time through the slow working out of purely economic forces. Its nation-wide adoption in place of timber mining, however, is still remote, and many obstacles lie in the path. The public must take a hand in hastening reforestation, or suffer during an unnecessarily protraced transition period. In face of the evils of increasing timber shortage and declining productiveness of forest lands it is urgently important to press the work forward.

It can safely be said that never before has the forest problem of the country been so much to the fore in the public mind. Further, there is increasing disposition to act on it; and there is an increasingly intelligent conception of what it really is. Nevertheless, the public does not yet see clearly and fully what ought to be done. It is largely groping in the dark.

There is need for leadership; there is need for much more in the way of public education, to the end that what is done may be intelligently done; there is need for creating a far greater body of knowledge than is now in existence, both to guide public policy and to shape private practice; and there is need not only to develop this knowledge but also to diffuse it in effective and manifold ways, so that it may actually reach and be used by those who will profit by it. All these needs are being met by the Forest Service to the extent of its resources, yet inadequately in comparison with what should be done.

In the forest industries there is taking place a very marked change of attitude toward reforestation. It is of real significance, but its interpretation must not be too hastily made. Powerful economic forces are beginning to create a distinct trend toward a new basis organization of these industries; yet many conflicting forces are at work, and it would be a series mistake to assume that a radical transformation is about to take place. Nevertheless, the process of conversion is under way.

The lumber industry, the naval-stores industry, and the pulp and paper industry are outstanding examples. In all of them serious thought is being given to timber growing as the source of raw material. Individual companies in considerable numbers are actually making investments with this end in view.

It is essential that this movement toward the practice of forestry on the part of landowners and industries be facilitated in every possible way. One way is through obtaining and communicating to them better knowledge of the methods that they should employ, of the returns that can be realized through use of these methods, and of the relative costs of improved and current practices. Another way is through public cooperation in the form of organized fire protection and tax reform, both of which necessitate State action. The Federal Government is now in position, through the provisions of the Clarke-McNary law, to extend help to those States which wish to receive this help. The largest immediate need in forestry is for State movements based on a clear conception of the forest situation and requirements in each State, to bring about the adoption of forest policies that will accelerate the trend now unquestionably perceptible toward timber growing as a voluntary private enterprise. Here again there is opportunity for the Forest Service to contribute much of value in leadership and knowledge obtained through research.

Watervliet Paper Co. to Expand

[FROM OUR REGULAR CORRESPONDENT]

WATERVLEIT, Mich., December 28, 1925.—An expansion program more than doubling the capacity of the Watervleit Paper Company's mill in this village and necessitating the outlay of over half a million dollars, is planned for 1926. Recommendations to this effect, unanimously approved at a recent meeting of the board of directors, will be submitted to the stockholders of the company, at the annual meeting January 20.

The proposed enlargements include the installation of a second paper machine, which can be accomplished without the need of much remodelling of the present machine room; the erection in the coating division of two 100 double coating machines, said to be the largest machines of their type in use in any paper mill in America and the installation of a large amount of auxiliary machinery.

Announcement of the expansion program to Watervleit's largest manufacturing industry was broadcast just at the Christmas season and is everywhere acclaimed as a fine Christmas gift. If carried out, as it is believed it will be, it will be as beneficial as securing another factory for this community and will insure its steady growth for the immediate years to come. The present operating force in the mill numbers 345 people, and the annual payroll is about $450,000. If the contemplated improvements are carried out it will materially increase the number of operatives.

The directors of the company will also propose to the stockholders that the capital of the company be increased from $820,000 to $1,000,000 by the sale of 18,000 shares of common stock of $10 par value each, at $20 for each share. The sale of this stock will net $360,000. It is also proposed to sell bonds to the value of $600,000.

Defiance Makes Change in Record Time

NIAGARA FALLS, N. Y., December 28, 1925.—It has only been a short 50 days since the reconstruction of the old Pettebone-Cataract plant was started by the Defiance Paper Company, which took over this Niagara Falls mill several months ago. But with the co-operation of the Hammermill Paper Company, the reconditioning of the machine, the transportation and installation of all the machinery and equipment was accomplished in record time.

Both paper machines are now in full operation, and are producing high quality sheets. The Yankee machine has been equipped to produce both light and heavy machine glazed sulphite papers in addition to the well known M. G. Seneca line, formerly made by Hammermill. It is also the intention to branch out into the specialty field and equipment is being added to take care of these requirements.

The M. G. Seneca line will be exactly as it has been in the past—the same high quality and embracing the same range of popular colors and finish. Pleasant and satisfactory relations have been established with all Seneca distributors, and they will continue to handle this brand in their respective territories.

The popularity of this line and the trade's faith in the ability of the Defiance organization has been evidenced by the continuous stream of orders which have come in while the changes were being made. Orders for a very large tonnage have been booked, and there is every indication that this new department of the Defiance will be kept very busy.

Bill to Investigate Pulpwood Production

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 28, 1925.—A resolution has been passed by the House of Representatives empowering the Committee on Interstate and Foreign Commerce, or a sub-committee of that committee, to investigate "the means of the control of production and exportation" of several important raw materials. While it was not included in the original resolution, Representative Snell, of New York, had pulpwood added to the list of materials to be investigated.

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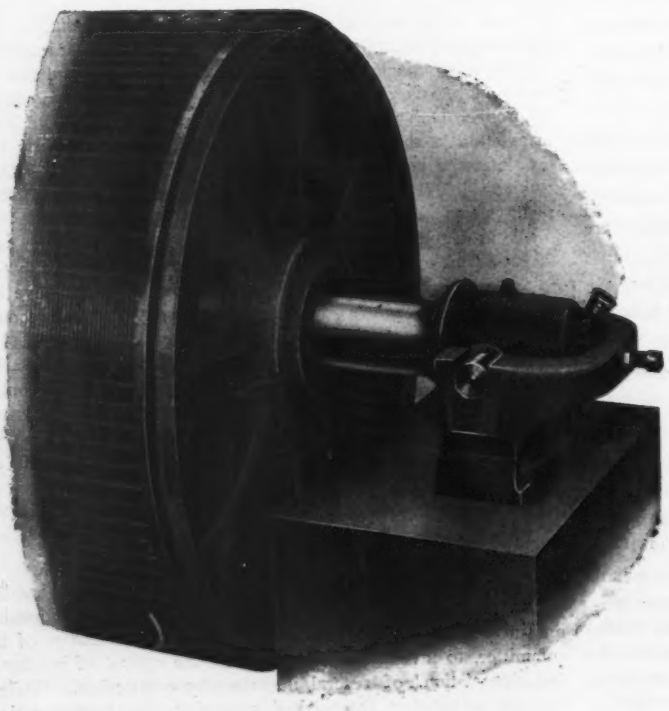

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Section of the
Technical Association of the Pulp and Paper Industry
AN ORGANIZATION FOR THE ENCOURAGEMENT OF ORIGINAL INVESTIGATION AND RESEARCH WORK IN MILL ENGINEERING AND THE CHEMISTRY OF PAPER, CELLULOSE AND PAPER-MAKING FIBERS GENERALLY; IT AIMS TO PROVIDE MEANS FOR THE INTERCHANGE OF IDEAS AMONG ITS MEMBERS IN ORDER THAT PROCESSES OF MANUFACTURE MAY BE MADE MORE EFFICIENT AND IMPROVED ALONG TECHNICAL LINES.
Conducted by W.G. MacNAUGHTON, Secretary

The Characteristics of Paper and Their Relation to Lithography*

By R. F. Reed[1]

The general conclusion from all of this work is that in order to print satisfactorily, paper must be properly conditioned so that its moisture content is in equilibrium with the atmosphere in which it is to be printed. To do this it is essential to control the relative humidity of the pressroom so that its variation during the 24 hours of the day and from one day to the next is confined to narrow limits.

Paper when freshly made is almost invariably drier than it should be to be in equilibrium with the atmosphere of the average pressroom, especially where the humidity is controlled. This condition necessitates the conditioning of paper in the pressroom before attempting to use it. Sutermeister[2] suggests that if something like uniform atmospheric conditions could be maintained in all pressrooms it would be possible for paper makers to supply paper having approximately the correct moisture content, thereby minimizing the conditioning necessary before the paper is used. This obviously would apply only where paper is shipped directly to the printer and would be of no avail where paper is held for long periods in jobbers' warehouses unless the humidity was controlled there also.

Experimental Work

As most of the above mentioned work was done a number of years ago, it was considered advisable that this laboratory should determine the characteristics of representative types of paper in use at present; establish if possible the limits of allowable variation in relative humidity that would be consistent with good results, and draw conclusions which will help to clarify the situation and make possible a more effective cooperation between the papermaker and lithographer.

A room was fitted up in which the relative humidity could be accurately controlled. The first step was to determine the time required to condition single sheets to a state of equilibrium with the atmosphere of the room. This was done by weighing sheets of several different papers every few minutes after transferring them from an atmosphere of 35 per cent humidity to one of 65 per cent humidity. It was found that the heaviest paper reached an equilibrium in less than 2 hours and the lightest in about 1 hour, and therefore 2 hours was subsequently allowed for conditioning in each case. The temperature of the room was maintained between 70 degrees and 80 degrees F. during the entire period required to complete the work. Two samples of each paper were exposed to these conditions. Weights were taken in atmospheres of 35, 45, 55 and 65 per cent, and measurements at 35 and 65 per cent relative humidity, and from these figures were calculated the percentage of moisture in the paper and the percentage change in dimensions found between the different humidities.

The results are summarized in the following tables:

AVERAGE MOISTURE CONTENT OF PAPER UNDER DIFFERENT CONDITIONS OF HUMIDITY

Kind of Paper	No. of Sheets	Relative humidity of atmosphere 35%	45%	55%	65%
Offset	18	4.04	5.06	6.08	7.09
S. and S.C.	6	3.55	4.43	5.30	6.17
M.F.	4	3.48	4.50	5.52	6.53
Casein coated one side	10	3.50	4.45	5.37	6.27
Casein coated two sides	2	4.67	5.61	6.57	7.55
All kinds	40	3.81	4.78	5.75	6.71

It is obvious from these results that the paper gained in weight roughly 1 per cent of moisture for each 10 per cent increase in the relative humidity between 35 and 65 per cent and that the gain is practically in direct proportion to the percentage relative humidity.

AVERAGE CHANGE IN LINEAR DIMENSIONS OF PAPER UNDER DIFFERENT CONDITIONS OF HUMIDITY

Kind of paper	No. of Samples	Average percentage change in linear Dimensions between 35% and 65% Relative humidity: Parallel to grain	Across the grain
Offset	9	0.056	0.311
S. and S.C.	3	.066	.342
M.F.	2	.039	.378
Casein coated one side	5	.122	.332
Casein coated two sides	1	.161	.408

Assuming that the results of previous work are correct in so far as they show the expansion to be a function of the moisture content, the percentage expansion or contraction between any two humidity values inside of these limits can be calculated from the above figures. These results check very closely with the results obtained by Sutermeister for the percentage change across the grain of the paper, but parallel to the grain there is a distinct difference. His results indicate that both in coated and offset papers the change across the grain was from 2 to 3 times the change in the machine direction. The work reported here shows this ratio to hold true only for the coated paper, while the change which took place in the offset paper across the grain is from 4 to 8 times the change in the machine direction. Since the amount of the expansion across the grain in offset paper was found to be similar to the other types of paper tested, this difference is of no particular importance.

* Abstracted from Bulletin No. 1 Research Series No. 1, Lithographic Technical Foundation.
[1] Director of Lithographic Research, University of Cincinnati.
[2] Chief Chemist, S. D. Warren Co., Cumberland Mills, Me.

Application of Results

Now let us apply these results to the practical problem at hand, assuming a sheet size 44 by 64 inches for register color work. As these sheets should be cut wherever possible with the grain running in the direction of their length, the maximum variation would be found in the 44 inch direction. Calculating from the average change of 0.311 per cent across the grain for offset paper between 35 and 65 per cent rel. humidity, we find that this variation would effect a change of 137 thousandths of an inch in the width of the sheet. For coated paper with a percentage change of 0.352, the variation would be 155 thousandths of an inch. In length the change would not be so marked. For offset paper it would be 36 thousandths, and for coated paper 71 thousandths of an inch. These changes in the size of the sheet would be disastrous to the attainment of accurate register in colors, but the changes in humidity from day to day are often as great as the range through which these measurements are taken. The only solution is therefore to control the humidity. If we assume a reasonable figure of say 20 thousandths of an inch or 0.045 per cent of the width for the maximum allowable variation in a 44 by 64 inch sheet, we can calculate from the above figures just what the maximum allowable variation in relative humidity should be to maintain the dimensions of the sheet within the necessary limits. For offset paper with a linear change of 0.311 per cent across the grain caused by a variation of 30 per cent in the relative humidity, the change of 0.045 per cent would correspond to a variation of only 4.3 per cent in the relative humidity. For coated paper with a change of 0.352 per cent across the grain the corresponding allowable variation in humidity would be only 3.8 per cent. It is safe to say that accurate register would not be obtained with work of this size if the relative humidity varied much more than 5 per cent during the entire run.

Relative Humidity in the Pressroom

The means of maintaining a standard relative humidity in the pressroom are limited for the average lithographer to:

1. Addition of moisture to the atmosphere if too dry.
2. Increasing the temperature if too wet.

It is of course possible to maintain any desired temperature and humidity conditions, but unless the humidity adopted as standard is as high as the maximum humidity of the outside atmosphere, an expensive installation will be required to reduce the humidity during the summer months when the temperature and humidity are both high.

An examination of the records of the U. S. Weather Bureau at Cincinnati indicates that during the months of October to May any one of the following conditions could be easily maintained by simple addition of moisture to the atmosphere:

45% rel. humidity at 78 degrees F.
50% rel. humidity at 75 degrees F.
55% rel. humidity at 72.5 degrees F.
60% rel. humidity at 70 degrees F.

since during these months the dewpoint of the atmosphere is comparatively low. During the months from June to September the dewpoint is often quite high and the conditions to be maintained by humidification would have to be changed to one of the following:

60% rel. humidity at 85 degrees F.
65% rel. humidity at 82.5 degrees F.
70% rel. humidity at 80 degrees F.
75% rel. humidity at 77.5 degrees F.

and even then there are two or three days in each month when the dewpoint of the outside atmosphere is too high to maintain these conditions, and difficulties will be encountered with work requiring accurate register. It is obvious that these difficulties will be most serious in shops where no attempt at humidity control is made, and also that they would not be felt at all in plants having efficient humidifying and dehumidifying equipment.

Plants in other geographical locations will have slightly different conditions to face in solving this problem, but it is safe to say that 55 per cent rel. humidity at 72 to 73 degrees F. during the winter and 65 per cent rel. humidity at 82 to 83 degrees F. during the summer months could be maintained without difficulty in the majority of lithographic pressrooms in the United States at comparatively small expense. Practically all textile factories are using similar conditions at the present time with very good results.

If such conditions were adopted and adhered to by lithographers, the following advantages would result:

1. Elimination of variations in size of paper effected by changes in humidity, after once conditioning it in the pressroom.
2. The amounts of moisture in paper under the conditions suggested are:

   For 55% rel. humidity approx. 6%
   For 65% rel. humidity approx. 7%

   Paper as shipped to the lithographer generally contains only 3 to 4 per cent of moisture and therefore would need to be conditioned. It is possible, however, for the papermakers to meet the conditions, if required to ship paper containing from 6 to 7 per cent moisture, and if this were done such paper as goes directly to the lithographer from the papermaker could be used safely with practically no conditioning.
3. Static troubles would be almost completely eliminated.
4. The durability of composition rollers would be materially improved, as they tend to deteriorate more rapidly in a dry than in a moist atmosphere.
5. It is claimed on good authority that controlling the humidity has a beneficial effect on the health of employees. In cold weather the air in heated buildings is extremely dry, often having a relative humidity of only 10 or 15 per cent, while outside it is 50 or 60 per cent. Humidifying the atmosphere in the pressroom therefore removes one of the chief causes of colds and related diseases.

Psychrometers for Paper Testing

As frequent inquiries are received by the Bureau of Standards, Department of Commerce, covering types of psychrometers best adapted for determining humidity in paper testing laboratories, information is being collected by the Bureau regarding such instruments. The Sling psychrometer is quite commonly used, but this type offers possibilities of error through delay in making readings and possibility of the body heat of the observer affecting it. The paper section of the Bureau uses a stationary type having the air circulated around the thermometer bulbs by means of a fan operated with a coiled spring. It is believed such a type minimizes the chances of error. A modification having an electrically operated fan was compared with the Bureau apparatus and was found equally efficient. Most thermometers used in psychrometers are made more especially for outdoor use, therefore, have a wide range with coarse graduations. Attempt is being made to secure thermometers having the comparatively small range required in paper testing work and of fine graduations to permit more accurate humidity determinations.

Pulpwood Cut Increases in New Brunswick

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 23, 1925.—The pulpwood cut for the 1925-26 season is estimated at 400,000 cords, a slight increase over that of last year. The demand is strong at present and buying brisk. Many pulpwood concerns are buying in the open market, according to a report from Vice Consul Johnson at Fredericton, New Brunswick.

Racquette River Takes Corporate Membership

The addition to the list of Corporate Members of the Technical Association of the Pulp and Paper Industry, of which there are now forty-two, of the Racquette River Paper Company, Potsdam, N. Y., F. T. E. Sisson, Manager, has been received. This is one of the most progressive firms manufacturing manila envelope and wrapping paper in the eastern United States.

The Composition of Lignin *

By Prof. L. P. Zhereboff.

The enormous growth of the paper industry in recent years is due not to developments in the chemistry of the process but to technical improvements. As a result of this the relative cost of the raw materials is increasing while other costs are decreasing, so that in the United States this cost now represents 60% of the cost of the finished product.

The cause for this lies in the fact that all the processes were carried on in an empirical way, and very little research work was done. We hardly know where we get our cellulose, what this cellulose represents, and we know still less the processes by which the cellulose is obtained from wood. Undoubtedly, better knowledge of the raw material would have enabled us to save much of what now is thrown into the river, and more economical production would have resulted.

Only recently considerable attention has been given to one of the chief constituents of wood, lignin. However, each investigator has followed his own ideas in this work and the results were often indefinite or even contradictory. The importance of the subject would perhaps justify calling a congress of those interested where each investigator might present his ideas and where there would be worked out a plan of cooperative action.

At present the literature on the subject is so scattered that a worker getting hold of only part of the available literature may be misguided rather than helped. The author has, therefore, decided to present here the collected material on the subject.

We know very little about the constitution of lignin, first of all, because there are no methods for obtaining it in the pure state. Lignin has been obtained from:

a. The residue of lignin compounds from pulp cooking liquors.
b. Wood treated with 64-72% sulphuric acid.
c. Wood treated with saturated (41-46%) hydrochloric acid.

Lignin from Sulphite Liquor

At first, the lignosulphonic acids were studied, which were obtained by the sulphite process. The study of lignin in this form appeared attractive, since in case of a successful solution of the problem much wood (over 6 million ton) now lost might possibly be utilized.[1] During pulp cooking the liquors are found to change continuously in composition both qualitatively and quantitatively. Finally, changed cooking conditions result in liquors of entirely different composition. These facts preclude the possibility of drawing conclusions regarding lignin thus obtained. For proof, Table 1 gives the results obtained by several investigators of lignosulphonic acids separated from sulphite liquors.

TABLE 1

	Lindsey and Tollet [a] [2]	Streeb [3]	Seidel [4] 3*	Seidel [4] b†	P. Klason [5]
Calculated formula	$C_{40}H_{44}O_{20}S$	$C_{40}H_{44}O_{20}S$	.....	.....	$C_{40}H_{44}O_{20}S$
Per cent carbon	50.88	50.22	56.27	53.69	49.34-49.79
Per cent sulphur	5.65	7.87	5.52	8.80-9.88	7.44
Relative sulphur content	100	139	98	156-175	132
Methoxy groups in the molecule	2	3	.....		3.8

* From sulphite liquors of a mill in Lower Austria.
† From sulphite liquors of Silesian mills.
[2] Annal. 267.341 (1892).
[3] C. Schwalbe, "Die Chemie der Cellulose." s. 421 (1900).
[4] Z. f. Angew. Ch. 13.951 u. 1307.
[5] Beitrage zur Kenntniss d. Chem. Zusammensetzung des Fichtenholzes (1911), s. 17.

It is seen that the relative sulphur content varies between 98 and 175, or nearly twice as much in one case as in another; furthermore, Seidel points out that there is more sulphur than necessary for a normal salt, while Klason finds 19% less sulphur than the formula calls for.

Evidently, no conclusion regarding the constitution of lignin can be drawn from these discordant data. Later investigators [6] have also found that in salting out lignosulphonic salts from sulphite liquors there are separated the salts of sulphonic acids as the concentrations are increased.

Lignin from Soda and Sulphate Liquor

Attempts to investigate the constitution and properties of lignin obtained from the liquors of the soda and sulphate processes have been still less successful. On account of the liquors being strong, acting at 160-170 deg. and at pressures of 6-8atm., not only does the lignin decompose but the carbohydrates are also broken up. It is not surprising, therefore, that while P. Klason [7] finds in these liquors largely the unchanged lignin, Lange,[8] and also Streeb, find only oxidation products: lignin acids (related to humic acids), and Rinman [9] finds ulmin substances and ulmic acids.

It should be noted, that in cooking wood by the sulphite, sulphate or soda processes, there are formed methyl alcohol, acetone, acetaldehyde, mercaptan, methylsulphide and dimethylsulphide, as a result of the breaking up of lignin. Evidently the liquors cannot give us the unchanged or only slightly changed lignin.

Lignin by Treatment of Wood With Acids

A better material for the study of lignin is the product obtained in the laboratory through the hydrolysis of wood with concentrated sulphuric or hydrochloric acid. Here we work with the pure wood and we obtain lignin free from admixtures; also, the hydrolysis takes place at normal pressure and at room temperature, since cellulose and most of the other carbohydrates are easily saccharified.

Indeed, lignin derived in the laboratory gives considerably more concordant results even for diverse species of wood. Thus in lignin obtained by hydrolysis with 72% sulphuric acid are found:

	Carbon %
Klason, in lignin from spruce	64.86
König, in lignin from spruce	64.85
König, in lignin from beech	65.08

Lignin obtained through hydrolysis is not, of course, the same as the natural lignin in the wood. The strong acids employed affect the lignin molecule and cause changes, some of which have already been established by many workers, while there probably are other changes as yet not determined.

The acids, first of all, saponify the ether-like side-chains of lignin. The groups OCH_3 and $OCH_2—CH_3$ break away. Therefore, the number of hydroxyls in the natural lignin is changed: they must increase. On the other hand, we do not know whether all the hydroxyls of the natural lignin have been preserved, and whether or not other hydroxyls besides those mentioned were liberated during the reaction.

The lignin resulting from hydrolysis when boiled with 12% hydrochloric acid forms furfural, pointing to the presence of pentosans. In order to reconstruct the formula of the natural lignin we must, for example, determine whether these pentosans are part of the lignin structure.

It is further necessary to find out whether the lignin obtained by this method is, aside from the pentosans, a homogeneous substance.

* *Bumazhnaia Promyshlennost* (Russia), III, No. 9, 495-506, and No. 12, 686-709 (Sept. and Dec., 1924). Translated by M. L. Caust, Member TAPPI.
[1] L. P. Zhereboff, "The Chem. of Sulphite Manufacture."

[6] Honig u. Spitzer. Monatshefte f. Ch. 39.435 (1917).
[7] P. Klason. Verhandlungen des Vereins d. Pap. u. Zellstoffchem. 1909, s. 84.
[8] Lange. Z. f. Physiol. Ch. 14, 15-30 u. 217-226 (1890).
[9] Rinman. "P. Z." 35. 221 (1910).

The Relation Between Hydrocarbons and Lignin in Wood

Now let us examine the relation between the hydrocarbons and lignin in wood. At present there is no definite view on this subject.

Payen (1835) [10] figured that cellulose forms the skeleton of the cell walls, while other substances which he called "incrustants" fill in the spaces in the skeleton.

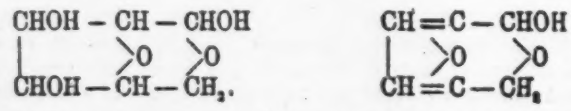
Twenty years later Fremy [11] came to the conclusion that the substance of the cell walls varied, since its reaction differed for different parts of the plant. While the envelope of some cells is xylose (Payen's cellulose), a different substance is found in each outer layer of other cells; furthermore, the envelopes of the central ray cells of bast fibers or the epidermis cells are again of a different chemical composition. Thus, besides xylose, he separated paraxylose soluble in Schweizer's reagent only after it is treated with dilute acid, also medulose, fibrose and dermose, the difference among these being an increasing difficulty of solubility in different reagents.

Later he changed these terms,[11a] but at present it is of no importance. It should be pointed out that he reported a firm bond, of greater or lower strength in different cases, between cellulose and Payen's "incrustants."

Fr. Schultze [12] (1857), having obtained "lignin" from different parts of the plant and having found it to be of homogeneous composition considered it, like Payen, to be built into the cellulose structure of the cell wall. Erdmann, on the contrary, finds that the wood of the silver fir, after separation from other additions, is insoluble in the ordinary solvents or in ammoniacal copper oxide and, therefore, contains no free cellulose, and is a stable chemical compound which he named glycolignose.[13] Through the action of hydrochloric acid glycolignose breaks up into glucose and lignose, and the latter forms cellulose on boiling with hydrochloric acid.

Stutzer (1875), also R. Sachsse (1877), considered wood to be a mixture of substances, "a sort of alloy" as Sachsse expressed it.[14] I. König,[15] Green, I Sachs [16] Fromherz,[17] Hoppe-Seiler,[18] Lange,[19] Czapek,[20] Grafe,[21] Cross and Bevan,[22] Schwalbe consider the turning into wood of the young cellulose plant structure as a process of gradual change of the cellulose itself or else the formation of a new ether-like combination between the cellulose and the substances in the cambium sap.

Green,[23] for example, shows that lignin is formed from cellulose by the separation of two hydroxyls:



resulting in an increase in carbon from 44.4% to 56.3%. According to Z. König wood is formed through the introduction of alkyls into the cellulose molecule: this process is irregular, which explains the presence in the cell wall of pure cellulose molecules with molecules containing alkyls. Both authors, evidently, do not recognize the aromatic base of lignin. Others, on the other hand, consider lignin to be an aromatic complex, forming with cellulose an ether-like combination through one of the hydroxyls of cellulose.

H. Wislicenus[24] offered (1910) a new theory of wood formation. He considers lignin to be the sum of all substances affixed to cellulose partly through adsorption and partly through the formation of a gel which covers the cellulose cell wall. The cell wall formed by such an *adsorption synthesis* represents a conglomeration of colloidal procambial substances. P. Klason [25] agrees with the above view, limiting the substances present according to the nature of the plant; therefore, he also considers lignin to be unattached to the carbohydrates.

Two Views in Regard to Wood

Thus we see the two views offered in opposition to each other: one, that wood is a simple mixture of various carbohydrates with lignin; the other, that it is a chemical compound. Yet any conception of the composition and properties of lignin is dependent upon the adoption of either of these views. If we are dealing with a simple mixture, then we have a right to expect a more uniform composition in the lignin we obtain; on the other hand, if it is a chemical compound then, as we know from organic chemistry, its decomposition would be influenced by the reagents employed, by the position of the various side-chains in the chemical complex and, finally, by the physical conditions of the decomposition.

There is no "chaos" in the composition of the wood. Every form of plant has a definite amount of lignin. For conifers, for example, this amounts to 28-31%, for broad-leaf plants, 21 to 24%. These variations are due largely to different methods of analysis and calculation.[26] Furthermore, when the biological conditions of the plants are considered, as for example, the extent of exposure to sun, or growth under pressure or tension, then the variations in lignin content become still smaller.

Products of Extraction

It is certain that adsorption of the substances dissolved in cambium sap by cellulose is a normal phenomenon; it is also possible, however, that the adsorbed substances enter into chemical union with the adsorbing substances after adsorption. Probably this is the explanation for the separation of some of the lignin from wood after warming with water. Even when extracting pitch from wood with alcohol we always find in the extract, besides pitch, fat and wax, also carbohydrates and lignin. After a short time the alcohol stops extracting anything more from the wood; water requires much more time for complete extraction. In all probability these extracts contain the absorbed lignin, while what lignin is left in the wood is chemically combined with the carbohydrates. By prolonged extraction with hot water and alcohol Klason obtained from spruce 10% carbohydrates and 2% lignin.[26] In determining the amount of pitch and fat in spruce by extraction with organic solvents the present author found up to 3% carbohydrates and lignin calculated on the dry wood.

Konig's Studies

König points out (Page 72-73 *l. c.*), that a small part of the carbohydrates and lignin can be extracted by the action of enzymes, for example, diastase, pepsin, or even by water at 2-3 atmospheres. The rest can be extracted by boiling with mineral acids at 1-3% concn., and under 1-3 atm. pressure. The first part of the extracted substances he calls the proto-group, *i. e.* they are proto-pentosans, proto-hexosans and proto-lignin (these proto-carbohydrates contain more carbon than the formulas of the corresponding carbohydrates call for). (Evidently because of the presence of some lignin—AUTHOR'S NOTE.) The second group he calls the hemi-group (analogous to hemi-cellulose). The remaining, chief part of the wood, which he calls the ortho-group, is brought into solution only through the action of conc. acid or

[10] Payen. "Ann. d. sc. natur." 1839. II, 1840, XIV, 1841, XVI. "Journ. f. prakt. Ch." 16, 436.
[11] Fremy. Compt. R. 48, 202, 275, 667.
[11a] Cellulose (xylose), paracellulose (paraxylose), metacellulose (dermose). The cell wall he called vasculose. He was also the first to separate "cutin" of the composition C-73.60%, H-11.43%, O-14.97%.
[12] Schultze. Ch. Zentralbl. 1857. No. 21. 321; Jaresber. d. Ch. 1857. 491.
[13] Erdmann. Ann. d. Ch. Suppl. 5. 223; Konig u. Rumpf, s. lou. Bente. Ber. 1875, s. 476.
[14] Sachsse. Die Chemie u. Physiologie d. Farb. Kohlehydr. u. Prot. 1877, 146.
[15] I. Konig u. Rumpf. Chemie u. Struktur d. Pflanzen-Zellmembran.
[16] I. Sachs. Experimentalphysiologie.
[17] Fromherz. Ztschr. f. physiol. Chemie. 50, 210 (1907).
[18] Hoppe-Seiler. Ztschr. f. physiol. Chemie. 13, 77 (1889).
[19] Lange. Ztschr. f. physiol. Chemie. 14, 15 u. 217 (1890).
[20] Czapek. Ztschr. f. physiol. Chemie. 27, 156 (1899).
[21] Grafe. Monatsh. f. Ch. 25, 967 (1904).
[22] Cross & Bevan. Cellulose. 1903, p. 201.
[23] Green. Z. f. Farben u. Textilchemie. 3, 97 (1904).
[24] Wislicenus. Z. f. Ch. u. Ind. d. Kolloide. 6 H. 1 u. 2 (1910).
[25] P. Klason. Beitr. z. Kenntn. d. chem. Zusammens. d. Fichtenholzes (1911) s. 39.
[26] A. Cleve v. Euler. Cellulosechemie. 1923. No. 1.

of weak acids with boiling at high pressure; the lignins of this group are brought into solution by oxidation. More explicitly, the *ortho*-group of wood is divided as follows:

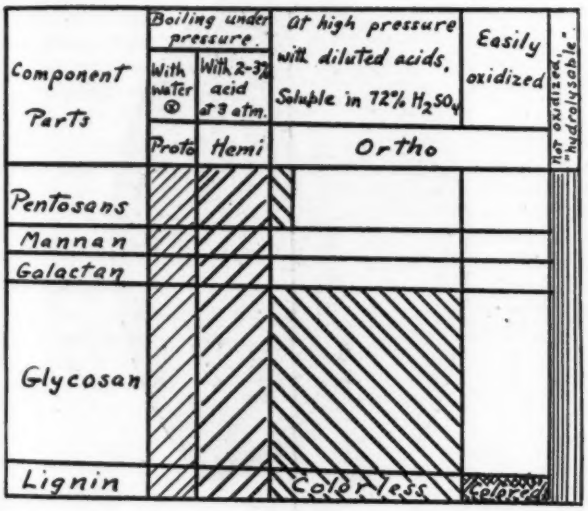
(a) Through the action of weak oxidizing agents, like weak solutions of hypochlorites, or of chlorine, bromine, nitric acid, 3% hydrogen peroxide and ammonia. These reagents remove all lignins leaving only ortho-cellulose and cutin which can be separated by means of ammoniacal copper oxide or zinc hypochlorite in hydrochloric acid.

(b) Sulphuric acid (72%) removes ortho-cellulose, the remaining ortho-pentosans and part of the ortho-lignin, giving with the ortho-cellulose a transparent colorless solution; in the sediment remain the dark colored ortho-lignin and cutin.

(c) Boiling with 1% hydrochloric acid for 5 or 6 hours, at 5-6 atm., causes the solution of ortho-cellulose, leaving cutin and ortho-lignin; here more of the latter is left than when 72% H_2SO_4 is used.

(d) Through the action of 41.4% HCl (sp. gr. 1.21).

In the following diagram König presents these reactions more clearly:



⊗ Also with enzymes and with pepsin + HCl

König considers the difference in the degree of solubility (Loslichkeitsgrad) of the proto, hemi and ortho carbohydrates and of the lignins to be due to the difference in degree of condensation in the wood; the differently condensed particles of lignin are distributed among the carbohydrate particles, but are not chemically combined with these.

Weak Points of Konig's Ideas

König's ideas are cited here in some detail in order to bring out their weak points. How can the existence of König's groups be proven? Experiments show that a change in the concentration, temperature or pressure of the reactions will change the amount of the wood undergoing hydrolysis. If, for example, instead of using 2 or 3% acid we use 1 or 1¼%, then more of the ortho and less of the hemi compounds are obtained. The composition of the hydrolysed substances also depends upon the strength of the reagents and upon the conditions of hydrolysis. König himself states that his proto-carbohydrates and proto-lignins contain more carbon than the corresponding hemi compounds. Changing the strengths of the reagents and the conditions of hydrolysis we can get not three groups, but scores of groups of carbohydrates and lignins. Therefore, we should ascribe the difference in the amounts of carbohydrates and lignins obtained from wood not to a difference in "degree of solubility," but to the extent of hydrolysis under different conditions. When the reagents are weak and the reaction not prolonged, only the molecules not firmly held in the wood complex are split off; at higher concentration, or even at low concentrations, but at high temperatures and pressures, the whole complex is broken up.

The separation of hydrochloric acid (Willstätter) lignin can be cited as an example. (Lignin obtained from wood by the action of conc. HCl by the Method of Willstätter and Zechmeister is usually called *hydrochloric* or *Willstätter* lignin, while if obtained with concentrated H_2SO_4 by the method of Klason or Ost and Vilkening it is called *sulphuric* lignin. Below, besides using these designations we shall also refer to *sulphite, sulphate* or *soda* lignin whenever the latter is obtained from the corresponding liquors in cellulose manufacture.) The pentosans which are usually present in wood cannot be hydrolysed completely unless the reactions are repeated or else when the hydrolysis is much prolonged as is seen in Table 2:

TABLE 2

No.	First treatment with HCl	Second treatment with HCl	Strength of acid		Pentosan in the lignin After 1st treatment	Pentosan in the lignin After 2nd treatment	Investigator
			Sp. Gr.	Per cent			
1	3 hours	3 hours	1.20	39.3	2.80	2.81	Geisler
2	1¾ hours	¾ hour	1.21	41.1	0.37	....	Fr. Oetter
3	1¾ hours	¾ hour	1.21	41.1	trace	....	H. Oetter
4	12 hours	1 hour	1.20	39.1	....	....	Ackermann
5	24 hours	.....	1.21	41.1	....	....	Göbbels

The Treatment

The treatment usually takes place at room temperature, using 39-41% acid. A slight difference in conditions, as the temperature of the room, affects the results. The age of the wood probably affects the results. In 1923, E. Hägglund worked on lignin using 41% acid, but at a constant temp. of 0 deg., and found that within certain limits the duration of treatment has no influence on the pentosan content of the lignin and does not change its copper number, thus:

Hours of treatment	Lignin found %	Copper number of lignin	Pentosans in the lignin cal. from the furfural %
½	24.43	5.6	6.64
2	25.01	5.7	6.55
3	23.21	5.5	6.66
12	24.44	4.6	6.38

The pentosan content decreases when the treatment is prolonged to 12 hours. Experimenting at 0 deg., but using supersaturated 45% HCl for only 15 minutes, he finds less pentosans in the lignin, but still a constant amount with repeated treatments. The copper number, which he found to be the same for fir and spruce lignin, also remained the same on repeated treatment with supersaturated HCl.

After the lignin thus obtained was hydrolysed by boiling with 5% H_2SO_4 until the pentosans were completely removed, the copper number of the remaining lignin went up to 25.92, pointing to the liberation of the carbonyl groups. The pentosan attached to the lignin was thus found to be not *xylan* but *araban*, since in the hydrolysis only arabinose was obtained.[29] Hägglund logically concludes from his experiments that *the pentosans* (or pentoses) *are chemically combined with the lignin.* (In my article in Buma. Prom. II No. 1, p. 143, 1922, I expressed the same opinion based on a number of observations.—AUTHOR.)

In studying this hydrolysis at the Moscow Forestry Institute more extensively, it was found that the concentration of the acid and the temperature are interdependent in their action. Thus 43.5% acid at 0 deg. does not complete the hydrolysis even after 48 hours; however, exposing the reacting mass to room temperature for less than 30 minutes, or even for the length of time required for the filtration of the acid from the lignin, causes the completion of the reaction.

A different line of hydrolysis,—alkaline, for example,—may cause a different decomposition of the wood complex. Thus, in the alkaline hydrolysis of straw the pentosans remain firmly united with the cellulose.

[29] Hagglund. Cellulosechemie. 1923. 7. s. 75.

E. Schmidt[39] and his co-workers offered (1921) a new method of wood hydrolysis by means of a 2-6% aqueous solution of chlorine dioxide. The wood then decomposes in the following manner:

The cell wall	Cell wall	Cutin, cellulose with the hemi-celluloses and the pentosans.
	skeleton substance	
	"Incrustations"	Hexosans and pentosans, combined with the cell wall substance which reacts with ClO_2.

Schmidt points out that ClO_2, unlike other hydrolysing agents, exerts no action upon the skeleton (*Ekeletsubstanz*) of wood, extracting only the incrustations which pass into aqueous solution during this process as well as during the subsequent treatment of the skeleton substance with sodium sulphite. The incrustations thus separated and dried on boiling with absolute alcohol give up to 60% polysaccharides.

The work of E. Schmidt apparently supported the views of Green, König and others, since lignin appeared to consist largely of carbohydrates. In reality, however, investigation showed that by Schmidt's method about 7% of the carbohydrates (pentosans and hexosans) went with the lignin extracted by washing the "skeleton substance" with sodium sulphite and water, these carbohydrates separating later on treatment with absolute alcohol. On the other hand, only part of the pentosans, about 4.4% remained with the cellulose in the "skeleton substance" of the wood (which fact Schmidt failed to observe).

Evidently here, too, the question revolves about the bonds among the separate components of wood and their arrangement at the moment of hydrolysis as influenced by the reagents employed and by the conditions of hydrolysis.

As a method of wood analysis Schmidt's procedure will never be employed, because it is too complicated and too long (6-7 days); it may perhaps be of use for the investigation of the relation among the basic components of wood.

Thus we see that there is no generally accepted view regarding the bonds existing between lignin and the carbohydrates. Also, that the composition of lignin is affected by the conditions of hydrolysis and by the reagents.

Observe, that the physiologists incline towards the opinion that there is a chemical bond between lignin and the carbohydrates of wood.

[37] E. Heuser. Cellulosechemie 1923. 7. s. 78.
[38] Hagglund. Cellulosechemie. 1923. 8. s. 85.
[39] Schmidt. Ber. 54. 1860. 3241 (1921), Ber. 56. 23 (1923), Ber. 56. 907.

The photomicrographs 1 and 2, from J. König and E. Rump's "Chemie und Struktur d. Pflanzen-Zellmembran," show the appearance of wood before and after the removal of the carbohydrates. Photomicrograph 1 shows the original wood, 2 shows the same wood after treatment with 72% H_2SO_4.

Apparently, after 70-72% carbohydrates have been removed the wood has shrunk up considerably. If the lignin were present as an incrustation within the meshlike structure of the carbohydrates then, upon removal of the latter, the incrustation ought to fall to pieces and appear in suspension or colloidal solution; instead of this, the texture of the cell wall remains in spite of the shaking it gets during the treatment. It seems that the threads in this tissue having lost most of their chemical constituents have become thinner and shorter, but have retained their structure.

Is lignin homogeneous or are there several different lignins in the wood?

Although P. Klason finds two forms of lignin in the alkaline wood cooking liquors, while other investigators have found in these a whole series of lignosulphuric acids of various composition, nevertheless, this gives us no ground for denying that the natural lignin is homogeneous. The dissolution of the wood during digestion takes place under various conditions of temperature, pressure and concentration of acid, therefore the complex can break up in different ways and, furthermore, the products formed change as the conditions are changing.

PHOTOGRAPH 1. ORIGINAL WOOD

PHOTOGRAPH 2. AFTER TREATMENT

Schmidt's work, as has already been pointed out, gives us material too unfinished to help us in solving this problem.

Is Lignin from Different Plants the Same?

Are lignins of different plants the same substance? Here again we lack the data for a definite answer. Apparently we can answer positively for related species; the lignins of fir and spruce, for example, are identical. The lignin of deciduous trees, however, is somewhat different from lignin of the conifers. The lignins of the graminaceous or the oleaginous plants, again, possess some differences. These differences, however, are not fundamental. The nucleus of the lignin molecule as well as the character of its side-chains is, apparently, the same in every case. The difference is, perhaps, in the number of hydroxyls, methoxyls, etc. If we assume that we are dealing with adsorption, then for different species and, even, in the same species, we could find all kinds of adsorbed substances; on the contrary, when a chemical compound is turned into wood a definite selection of substances from the cambial solution is required and the arrangement of these in the lignin molecule must be definite.

Thus in the lignins from jute, rye straw and flax stalk we find the same nucleus and the same side-chains, i. e. methoxyls and acetyls, as in lignin of fir and spruce wood. The size of the molecule and its empirical composition does not vary much in these lignins.

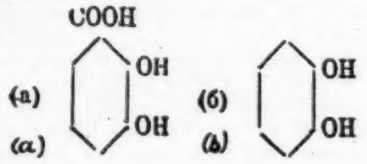
Jute lignin (Cross and Bevan)	$C_{40}H_{44}O_{20}$
Fir wood lignin (Klason)	$C_{40}H_{46}O_{22}$
Straw lignin (Beckmann u. Lische)	$C_{40}H_{44}O_{18}$
Flax lignin (Powell and Whittaker)	$C_{40}H_{46}O_{18}$

The differences are explained by the different methods used in separating the lignins. While the investigators of lignin from conifers employed the ruthless methods mentioned above, like concentrated acids, high temperatures and pressures, only a 10% NaOH solution was used for the separation of flax lignin at 130 deg., and the straw lignin was obtained by the action of 1½% NaOH solution at room temperature. It is clear, therefore, that identical results could not be obtained.

The Composition of Lignin

In order to determine the composition of lignin, investigators employed various reactions bringing about the dissolution of the complex lignin molecule into simpler molecules the structure of which either is known or else can be easily determined. Such reactions were: (1) fusion with alkalies, (2) treatment with reducing or (3) oxidizing reagents and (4) decomposition through dry distillation of lignin.

On fusion of wood with alkali Erdmann found *pyrocatechin*, leading him to recognize an aromatic ring in the lignin molecule. Buddeus (1891) also found *pyrocatechin* on dry distillation of the solid residue of sulphite liquors which were first treated with ammonia.[81] Later many workers[82] obtained *protocatechuic* acid (a) and *pyrocatechin* (b) by fusing wood with alkali, but the appearance of phenol at certain times and of acid at other times, insufficient yields of these, and, mainly, the occurrence of signs that cellulose also yields protocatechuic acid did not justify definite conclusions.



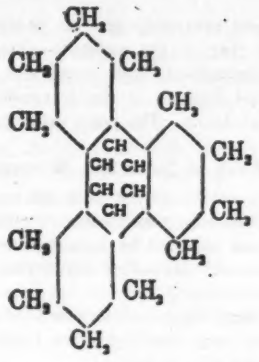
Very recently Heuser, Winswold and Hermann[83] have successfully explained the causes for insufficient yields and the variations in these reactions with KOH. They have established the strong oxidizing action of oxygen of the air causing the protocatechuic acid former by fusion to be further oxidized into oxalic acid. When the reaction takes place in an atmosphere of hydrogen, the fusion of lignin yields 28% protocatechuic acid. In the ordinary atmosphere even pure protocatechuic acid on fusion with KOH forms up to 20% oxalic acid, while none of the latter is formed in a hydrogen atmosphere. An iron crucible or, still better, iron filings serve as the catalyzer and help the splitting off of the carboxyl group and the change of the acid to pyrocatechin.

Cellulose, when fused with KOH under such conditions, forms neither protocatechuic acid nor pyrocatechin.

Thus the reactions resulting from fusion with KOH indisputably indicate the presence of an aromatic ring in lignin.

Experiments employing the reduction of lignin point to the same conclusion. Willstätter and Kalb[84] using hydriodic acid and phosphorus as reducing agents obtained polycyclic hydroaromatic hydrocarbons.

[81] Zhereboff. "The Chem. of Sulphite Manuf.", p. 170.
[82] Honig u. Fuchs. Monatsch. f. Ch. 1919, s. 87. 1920, s. 221.
[83] Heuser u. Winswold. Cellulosechemie, 1923. Nos. 5 u. 6.
[84] Willstatter u. Kalb. Ber. 55. 2637 (1922).



W. Schrauth finds in one of the fractions of the hydrocarbons of Willstätter and Kalb a striking resemblance to hydrogenated benzophenanthrene $C_{18}H_{10}$ of the structure as shown below.[85] His figures strongly support this view:

	C	H	%C/%H	Mol. Wt.	20 deg. d 4 deg.
Willstätter u. Kalb.....	87.85	12.68	6.93	243.8	0.9500
Schrauth u. Görig.....	87.81	12.31	7.13	246.3	0.9425

Karrer using weaker reducing conditions by distilling lignin with zinc dust at 2mm. pressure also obtained aromatic hydrocarbons of approximately the same molecular weight as Willstätter and Kalb's, and one of these apparently corresponded to the formula $(C_6H_3)_4$, *i. e.*, it contained much less hydrogen than did the hydrocarbons of the other investigators.

Oxidation of Lignin

When lignin is oxidized it is hard to preserve its nucleus, since the molecule easily breaks up into the simplest compounds of the aliphatic order, like oxalic, acetic, formic, and carbonic acids. This is observed on fusion with KOH, and some methods for the determination of cellulose in wood are based upon this property of lignin, the lignin being completely destroyed by oxidizing agents while the cellulose remains. The reagents acting thus are $KMnO_4$, H_2O_2, HNO_3, etc.[86] If complete dissolution of the molecule is to be avoided the conditions of the reaction must be most gentle. Klason, oxidizing lignin with a dilute solution of H_2O_2 at room temperature for 45 days, arrived at the point where the aldehyde group changed to a carboxyl, and one methoxyl changed to a carbonyl group,[87] *i. e.*, the nucleus of the molecule remained intact, and, therefore, the experiment gave no data of help in our discussion. In H. Schrader's experiment, where lignin was oxidized in a weak soda solution by passing air through it for a period of 8 months, the dissolution went further. This method of oxidation caused 28% of the lignin to change to humic acids, *i. e.*, substances of aromatic structure.

Oxidation of lignin proceeds more energetically in a 2.5/N Na_2CO_3 solution, but under pressure and at 200-300 deg., as was shown by Fr. Fisher and H. Schrader.[88] After 2-3 hours some of the substances found were: CO_2, oxalic, acetic, formic acids, methyl alcohol, neutral oil, humic acids, mellitic, pyromellitic, and benzol-pentacarbonic acids, *i. e.*, the ring of the molecule was broken here forming various aromatic acids.

A fourth method for the study of lignin consisted in dry distillation and was employed by many investigators,[89] both at Normal pressure and *in vacuo*. The very large amount of CO and the negligible quantity of CO_2 formed deserve pointing out. Among the pitch products of distillation we find up to 40% phenols.

Thus fusion with KOH, reduction, oxidation and, finally, dry

[85] Schrauth. Z. f. Ang. Ch. 1923. No. 21.
[86] J. Konig. Cellulosechemie. II. 14. u. 113 (1921).
[87] Fischer u. Schrader. Abh. Kohle 4. 13 (1919) 5. 200-210, 221-229 (1920) C. (1922) 1064. C. (1922) 1185.
[88] Fischer u Schrader. Abh. Kohle. 5, 108 (1920).

distillation of lignin invariably give as products of the dissolution of the basal ring of the molecule—phenols, aromatic acids and aromatic hydrocarbons, both mono and polycyclic. *All of these considerations lead us to the recognition of the aromatic ring in the lignin molecule.* The great majority of chemists accept this view.

Work of Jonas and Marcusson

There are, however, those who take the opposite stand. Aside from Schulze, Green, König and others mentioned above, whose objections have been removed by later workers, we find, of late, Jonas[39] and Marcusson[40] defending the aliphatic structure of lignin.

According to Jonas, lignin consists not of chains of benzene rings, but of furan rings resulting from further condensation of the pentoses, proving this as follows.

The aromatic acids in sulphite liquors amount only to a fraction of one per cent. In cambial sap only a negligible amount of aromatic substances are found. Humus substances resulting from decomposition of lignin are, likewise, not aromatic, but furan compounds since he succeeded in obtaining these from furfural, pentose and hexose.

Similarly, Marcusson shows experimentally the possibility of obtaining humus substances from furan compounds, which indicates the admissibility of a furan structure of lignin.

Still, these arguments are not convincing. One can speak of the small quantity of aromatic acids in cellulose liquors only by denying in advance the aromatic ring of lignin. The phenols, for example, which are obtained on dry distillation of the solid residue of these liquors would then have to be explained as a product of decomposition of carbohydrates and furan compounds. The work of Heuser and Willstätter, already cited, which appeared after Jonas and Marcusson reported their results, showed the *direct* formation of aromatic compounds from lignin (denied by Jonas), and even up to 28% of these.

The fact that aromatic substances are found in cambial sap in negligible quantities proves nothing, since the glucoses and pentoses which form the entire mass of the wood are also found there in insignificant amounts. There is only a negligible amount of carbonic acid in the air, and yet it forms annually enormous amounts of organic material.

That humus substances represent an intermediate link between lignin and aromatic substances in coal is admitted by Jonas (l.c).

Does the fact that humus substances are obtained from furan compounds deny their formation from the benzene ring of lignin?

Arguments Not Convincing

Humic substances, because of their high molecular weight, colloidal nature and, consequently, impossibility of exact identification, cannot at present serve as a basis for the solution of such complicated problems. Fischer and Schrader have shown that humus substances of natural origin give on dry distillation phenoses, for example, while these are not obtained from the laboratory product. The same investigators obtained mellitic and benzol-carbonic acids alongside with the aromatic humic acids by the oxidation of lignin under pressure. Therefore, all the arguments of Jonas and Marcusson for the furan nucleus of lignin, especially when recent work of others is considered, do not appear convincing. I wish to point out here, in connection with Schrauth's hypothesis presented below, the possible connection between benzene and furan rings. To one of the furan compounds obtained by him, Marcusson assigns the accompaying formula of a benzene ring with an inner oxygen bridge. The breaking of any of the benzene bonds will result in a furan ring. Below in the hypothesis of Schrauth we shall see an attempt to form lignin from a combination between benzene and furan rings.

In so far as the side-chains of lignin are concerned, while their qualitative determination is not as difficult as is the determination of the nucleus, yet so far no one was able to establish their quantitative relation. By hydrolysis of wood with acids or alkalies we split off acetic acid and methyl alcohol. Since under these conditions cellulose does not yield these products, it is evident that they are formed from lignin by the splitting off of acetyls (OCH_3CH_3) and methoxyls (OCH_3). The latter are also found in wood by heating with hydriodic acid[41]. These acetyls and methoxyls replace some of the hydroxyls in lignin, forming with the lignin nucleus the corresponding ethers; saponification of these reestablishes the corresponding hydroxyls.

Treatment of Acids and Alkalies

The separation of lignin from wood with acids and alkalies causes, at the same time, the saponification of part of these ethers, therefore, we cannot find any acetyls in the lignin and we find only part of the methoxyls of the natural lignin.

Pringsheim and Magnus found 4.2% acetyls in wood, and repeating the treatment (NaOH under pressure) found 1.5% more, or altogether 5.7%.[42] Heuser and Ackermann,[43] saponifying with 50% H_2SO_4, obtained 3.98%, by Schorger's method—4.08%, and by Pringsheim and Magnus's method—4.17%, i.e. 4.08% average of acetic acid, or figured on the natural lignin—14.7%.

Hägglund and Malm[44] found 4.65% methoxyls in wood, or 16.7% methoxyls in the molecule of natural lignin.[45]

In order to figure the number of acetyls and methoxyls in the lignin molecule from the above percentage figures we must take into account the empirical formula, but as different authors accept different formulas, the resulting calculations vary.

Using Klason's formula $C_{41}H_{46}O_{14}$ and Heuser's figures of 14.7%, we find two acetyls in the lignin molecule since the formula $C^{41}H^{38}O^{12}$ ($OCOCH^3$) calls for 14.29% acetic acid.

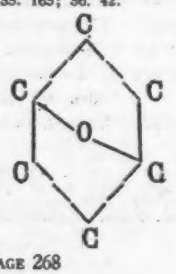
Using the same formula and Hägglund's 16.32% methoxyls in the natural lignin, we find four methoxyls in the lignin molecule; however, Hägglund using a modification of Willstätter's method in obtaining the lignin accepts only two methoxyls for the lignin molecule as his formula is different—$C_{19}H_{18}O_8$ $(OCH_3)_2$.

The hydroxyls of lignin cannot be determined while these are in the wood together with the hydroxyls of the carbohydrates, therefore the determination must be made after the lignin is separated. The hydroxyls are usually determined by methylation or acetylation of the separated lignin. The resulting ethers are saponified and, subtracting from the total methoxyls or acetyls those originally present in the lignin, we find those formed from the hydroxyls. Thus, Heuser, Schmidt and Gunkel obtained by methylation a product containing 26.29% methoxyls; deducting 17.80% methoxyls of the natural lignin (according to Hägglund) they find 8.49%, which figures to three free hydroxyls in the lignin molecule according to the empirical formula of Klason.

By acetylation of Willstätter lignin Heuser and Ackerman obtained a product with 32.5% acetic acid. Above we stated that they found 14.7% acetic acid in the natural lignin. Therefore, 32.5-14.7=17.8% acetic acid replacing the free hydroxyls in Willstätter's lignin, which figures again to three free hydroxyls in Klason's formula.

with 2 acetyls—C41 H38 O12 (OCOCH3) 2—14.05% acetic acid
with 3 acetyls—C41 H37 O11 (OCOCH3) 3—20.07% acetic acid

[39] Z. F. Angew. Ch. 34. 289 (1920); also report to the German Society of Natural Science and Medicine, Sept., 1922.
[40] Z. f. Angew. Ch. 437, 35. 165; 36. 42.



[41] Zeisel and Stritar's method.
[42] Calculated for lignin free from ash and carbohydrates.
[43] Z. f. physiol. Che. 105. 179 (1919).
[44] Heuser u. Ackerman. Cellulosechemie. 1924, No. 2.
[45] Hagglund u. Malm. Cell.-chemie IV. 7. (1924).
[46] $C_{19}H_{18}O_8$ $(OCH_3)_2$ calls for 18.77% (OCH_3).

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These investigators consider that their result (17.8%) speaks for three free hydroxyls.

Work of Hochfelder

Hochfelder, starting with lignin obtained from wood by the action of phenol, attaching acetyl and benzene groups, also finds three free hydroxyls. However, if in calculating from the percentage quantity of hydroxyls a different formula is used, for example, Hägglund's, then as has already been shown in the case of the methoxyls, the number of hydroxyls in the molecule would again come out different. Furthermore, we must remember that any empirical formula based on the analysis of lignin, which is obtained by any of the described methods does not represent the true lignin molecule, but one that has been changed either by loss of some side-chains or otherwise; therefore, all calculations of acetyls, methoxyls and hydroxyls must be considered only as approximate orientating data.

Not until we find a method for the separation of the unaltered lignin molecule from wood shall we be able to determine the exact number and relation of the different groups in it.

It is worth while comparing the content of the groups we are now considering with that in the lignins from oleaginous and gramineous plants.

Powell and Whittaker

Powell and Whittaker[47] found in the lignin of the flax stalk separated with 10% NaOH, under pressure and at 130 deg., four methoxyls and five hydroxyls that can be acetylated. Their formula of the lignin is: C40 H30 O5 (OCH3)4 (OH)5 .CHO *i. e.*, the compound has also one aldehyde group.

Three of these hydroxyls are of a phenol nature, because they are easily introduced into the molecule even of no more than three methoxyls. The character of the remaining hydroxyls has not been definitely established, but their unstable nature is shown by their absence in the lignin derivatives. Thus in chloro- and bromo-lignin only seven hydroxyls are found, some of which are methylated. Chloro-lignin easily gives up half of its chlorine on treatment with alkali, but firmly retains the remaining 6 atoms of chlorine; this fact, in the opinion of the authors, suggests that these 6 atoms replace the hydrogen atoms in the benzene ring. In the acetylated lignin all 5 hydroxyls are replaced by acetyls: C40 H30 O6 (OCH3)4 (OCOCH3)5 .CHO.

For methylated and chlorinated lignin they found the following composition:

C40 H30 O6 (OCH3)4 (OH)2 .COH and
C40 H20 08 Cl12 (OCH3)2 (OH)5 .COH

The investigations of these workers have shown that this lignin is strongly unsaturated and contains an aromatic ring.

Beckmann and Liesche

Beckmann and Liesche found in rye straw 4 methoxyls and 4 hydroxyls which are easily replaced by benzyl, brom- and nitro-benzyl groups.[48]

Cryoscopic determination of the molecular weight of lignin dissolved in phenol made by Beckmann showed it to be between 784 and 1057. Comparing the compositions of the different lignins it appears that flax and straw lignins are much alike, while sulphite lignin is less similar to these.

Empirical formula	Flax $C_9H_{10}O_3$	Straw $C_9H_{10}O_3$	Fir (Hägglund) $C_9H_{10}O_3$*	Fir (Klason) $C_9H_{10}O_3$*
Per cent C	63.9	62.8	64.5	55.0
Per cent H	5.8	...	5.4	5.6
Per cent O	30.5	31.2	30.0	40.3
Per cent OCH3	14.9	15.5	...	17.4
Molecular weight	840	784-1057	784	872
In acetylated lignin, per cent (COCH3)..	20.4	18.4	...	19.5
In acetylated lignin, per cent (OCH3)...	11.8	13.3	...	14.0

* Doubling the formula.

[47] Journ. Ch. Soc. 125. 357 (1924). Cell.-chemie. 1924. No. 3.
[48] Beckmann u. Liesche. Z. f. Ang. Ch. 34. 465 (1921).

The accompanying table shows that not only are the lignins from flax and straw closely related, but Hägglund's lignin is also similar. Klason's sulphite lignin obtained by the action of acids at higher temperatures is considerably different both in carbon and oxygen content. However, I have already pointed out that sulphite lignin differs materially from the natural lignin and must not be used for the study of the latter.

Thus we see that, *even the lignins of different plants equally contain the aromatic nucleus, approximately the same percentages of methoxyls and several free hydroxyls, which are in the natural lignin partially replaced by acetyls. Quantitative differences are easily accounted for by the action of hydrolyzing agents employed for separation.*

Presence of Aldehydes or Ketones

Besides the groups which we have taken up, most investigators accept the presence of aldehydes in the lignin molecule, others admit the probability of ketones being present, while some presume that carboxyls are also present. We must admit that there are no definite analytical data to support any of these views. The probability of aldehyde or ketone groups is based on the reducing power of lignin. We know that Fehling's solution and the salts of the heavy metals are reduced by wood and also by lignin obtained from it. Furthermore, lignin reacts with SO_2 and with bisulphites, attaches phenyl hydrazine sulphuryl hypochlorite, aniline (Paschke), napthylamine and other aromatic amines (Klason). Klason has repeatedly attempted to prove that there is in lignin an acrolein group, *i. e.*, that the nucleus of lignin, R, has acrolein as a side-chain, R-CH:CH.CHO, and that the sulphite process is possible only because of the presence of this acrolein group. Sulphurous acid replaces the double bond forming sulphonic acid:

$$R \cdot CH{:}CH \cdot CHO + H \cdot SO_2OH = R \cdot CH_2 \cdot CH\begin{matrix} SO_2OH \\ CHO \end{matrix}$$

In the reaction between lignin-sulphuric acid and *beta*-naphthylamine which he discovered, he sees new evidence that acrolein is present in the side-chain of lignin, accepting the formation of a cyclic napthylamine salt:

$$R \cdot CH_2 \cdot CH\begin{matrix} SO_2O \\ CH : NH \cdot C_{10}H_7 \end{matrix}$$

If napthylamine neutralizes sulphonic acid forming the usual type of salt, then this salt should be soluble; while in this case, adding napthylamine hypochlorite to the acid solution of lignosulphonic acid, we get a yellow insoluble deposit. Evidently, says Klason, there is an aldehyde group which after addition to it of napthylamine forms a closed cyclic salt of the above structure and is precipitated out.

On slight warming caustic soda displaces part of the napthylamine from this salt, and on removal of the separated napthylamine with ether there is obtained a brownish-red solution, which after acidification and new addition of napthylamine hypochlorite again forms the yellow deposit of cyclic (?) salt.

Heating of the brown aldehyde (C_6H_5—CH:CH—CHO) which has a structure analogous to Klason's lignin with bisulphite he obtained a compound which also gives an insoluble deposit with napthylamine. He sees in this new proof in favor of his lignin formula with a sidechain of aldehyde (acrolein).

However, S. V. Hintikka[49] denies that Klason's arguments are convincing, stating that even if there is an aldehyde group in lignin, which he doubts, yet napthylamine can form the compound HO_3S—R—CH:N.$C_{10}H_7$ (Schiff's salt), where HSO_3 is not attached to the aldehyde group. Indeed, having obtained ligno-

[49] Hintikka. Cellulosechemie.

sulphonic salt of napthylamine and having dissolved it in aqueous acetone, he got a calcium salt in which the CaO content exactly corresponds to the formula $C_{30}H_{28}O_{18}S_2N_2Ca$, *i. e.*, the napthylamine compound of lignin really contains free HSO_3, unattached to the aldehyde. When acid is added to the solution of this lime salt, Klason's yellow deposit separates again.

Fuchs[40] also finds Klason's conclusions to be unfounded. Napthylamine precipitates are easily explained by the formulas of Dorée and Cuningham containing unsaturated cyclic ketone groups. As to the sulphite process, the bisulphite or HSO3 can join any carbonyl group, or replace any double bond of the cyclic ring, or, finally, replace phenol hydroxyl, forming ether. Considering the nature of sulphite compounds formed during cooking the last two combinations are more probable, since one part of SO_3 is easily split off by the action of acids or alkalies (phenol ethers), while the other, on the contrary, is very firmly held, which is characteristic of aromatic sulpho acids. Finally, quantitatively the reducing power of lignin is very low.

Let us further point out, that also in the opinion of Schwalbe, Klason's conclusions rest merely upon one unfounded analogy.

Indeed, if there is an aldehyde in a side-chain then we have a right to expect more clearly expressed aldehyde characteristics; yet these are not found in lignin. Lignin separated from wood reacts with bisulphite only to a slight extent (4-13%) and even then in a sealed tube and at a high temperature.

While Klason finds only one aldehyde group, Paschke figures three aldehyde or ketone groups in the molecule of straw lignin, because it takes on three molecules of sulphuryl hypochlorite or three molecules of aniline. Powell and Whittaker figure that in lignin from flax the aldehyde group is hydrated, but appears in its derivatives. Dorée and Cuningham accept five ketone groups for jute lignin. Thus, although most investigators recognize the presence of aldehyde or ketone groups in lignin, their number, exact nature and position are still in doubt.

The same can be said still more truthfully regarding the existence of a carboxyl group (Klason); there are no definite data proving its presence.

The Structure of Lignin

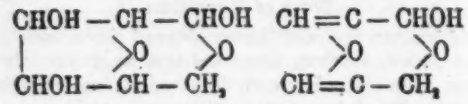
If we know the size of a chemical molecule (molecular weight), the number of separate atomic groups, their character and mutual bond, *i. e.*, whether there is an aliphatic open chain or, on the contrary, closed mono or polycyclic rings, then we are able to represent the results of our analyses graphically as a structural formula, where the position of the different groups would indicate the characteristics of the compound as well as its genetic relationship to other known compounds.

Structural Formulas Represent Opinions

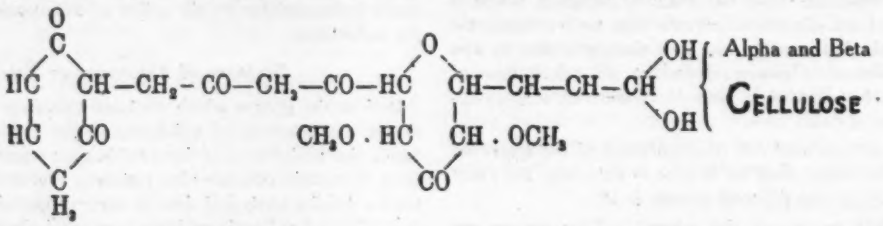
But how are we to derive the structural formula of lignin when the data are in the condition as already described? How can we agree on a graphical formula when there is no agreement regarding the presence of an aromatic ring, when some point out the presence of carbohydrates, when we do not know the number of side-chains nor the nature of its oxygen groups. Therefore, all suggested formulas must be regarded not as resting upon conclusive data, but as expressing the opinion of this or that investigator. This is proven by a comparison of the formulas.

[40] Fuchs. Ber. 54. 484 (1921).

Green, as we have seen, derives the lignin formula from his cellulose formula (not recognizing its benzene nucleus) by taking out water:



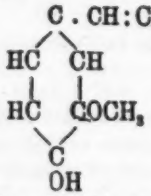
Dorée and Cuningham, developing the basic idea of Cross and Bevan, bring out in their formula the presence in lignin of one benzene and one pyrone ring with five ketone groups and two methoxyls in the pyrone:



This entire lignin complex is connected with carbohydrates through a cellulose bond. Both rings of this formula are in dispute and, besides, the absence of acetyls, shortage of methoxyls and hydroxyls and excess of ketone groups do not correspond to the analytical data already cited.

Formula of Klason

The formula quoted most is Klason's. During 15 years he changed his formula three times, but the chief motive of all his work expressed in his formulas is the formation of lignin from coniferyl alcohol. The formula of coniferyl alcohol is the main nucleus or, later, one of the main rings in his lignin molecule. In his work published in 1910 he finds the composition of sulphite lignin to be C40 H42 O11 and says: "If we quadruple the formula of coniferyl alcohol ($C_{10}H_{12}O_3$) and assume that on condensation three molecules of H_2O are dropped and two CH groups are changed to 2COH, then we get the formula C40 H42 O11, so that the thought naturally arises that lignin is a condensation product of coniferyl and oxy (COH) coniferyl alcohol." We have:



already noted that the side-chain of this alcohol (CH:CH. CH_2OH), converted by Klason into the corresponding aldehyde (acrolein), is in his opinion responsible for the sulphite cooking process and, vice versa, it proves the coniferyl nucleus of lignin; we also saw, however, Fuchs's and Hintikka's rejection of this view.

The conception of coniferyl alcohol as participating in the formation of lignin is quite natural. It was found long ago that coniferin (glucoside of coniferyl alcohol) was present in the cambial sap of the conifers.

Before Klason, Grafe obtained vanillin,[41] pyrocatechin and methylfurfural as decomposition products on heating wood with water under pressure, and concluded that wood contains 40% of substances related to vanillin. Czapek, heating wood with acid and Zn Cl_2, obtained the same substances and drew analogous conclusions. Klason warmed wood thirty times, for 8 hours each time, first with water, then with 1/3 per cent acetic acid, making extractions with alcohol alternately with these

[41] Observe that Dorée and Cuningham, Wichelhous and Lange, Honig and Fuchs could not obtain vanillin either from wood or from sulphite liquors: Klason was also unsuccessful.

treatments, and obtained 10% of the weight of the wood as a water extract and 2% in the alcohol. The water extract contained chiefly pentoses, while the alcohol extract partly yielded a substance constitutionally close to coniferyl alcohol, although of a somewhat different molecular weight[83] and another substance which Klason considers to be oxyconiferyl alcohol (although the analytical results do not fit in sufficiently). The substance which he obtained gives a vanillin odor when oxidized with chromic acid. These data (after what was already stated regarding the derivation of the structure of lignin from ligno-sulphonic salts) form really the only proof that natural lignin contains a coniferyl nucleus. But is this proof sufficient? Klason obtained only 0.4% of the weight of the wood as the supposed coniferyl alcohol, after hydrolysis lasting 240 hours which caused the decomposition of most of the pentoses in the wood. Grafe and Czapek based their conclusions on yields of 0.08%. Are such yields sufficient to lead us to recognize coniferyl alcohol as the basic ring in the wood? Are not these substances products of decomposition of other constituents in the wood which are easily hydrolysed, perhaps those substances which accompany pitch and fat when these are extracted from wood with alcohol?

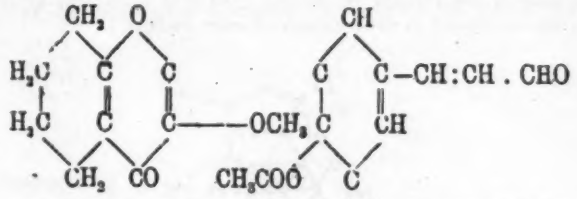
Formation of Vanillin

Vanillin has been found more than once to result from wood decomposition. The present author has observed the formation of a considerable amount, evidently of a pathological nature, on spring exudation from a shrub, also, on decomposition of oak wood on heating in the absence of oxygen, also in sulphite liquors under exceptional cooking conditions. It can frequently be detected on releasing the steam from the digesters after steaming the wood to obtain brown pulp, but does this prove that it originates from the coniferyl ring of lignin? If its structure is close to that of coniferyl alcohol, yet, on the other hand, it is also close to other compounds like protocatechuic aldehyde or acid.

It is seen from the graphical formulas that vanillin or vanillic acid differ from protocatechuic aldehyde or the acid only by one methoxyl, and we saw above that when lignin or wood is decomposed by fusion with KOH the main product was protocatechuic acid. Furthermore, Melander[84] and others found vanillic acid to result from a similar decomposition. Therefore, the formation of vanillin on decomposition of lignin does not at all prove that coniferyl alcohol must play a part in the formation of lignin, but rather it affirms the presence of an aromatic ring in the molecule.

Klason's Theories

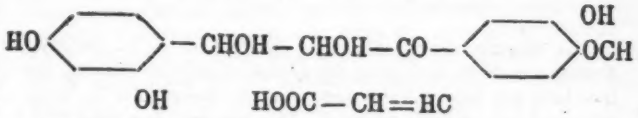
For a certain period Klason rests his theory of coniferyl and oxyconiferyl alcohol and considers lignin as a combination of one molecule of coniferyl alcohol with six molecules of methyl-oxalyl-pyrogallic acid and six molecules of oxalyl-pyrogallic acid, *i. e.*, coniferyl alcohol already forms 1/13 part of lignin. Still later we encounter Klason's latest theory where, based upon analyses of substances separated from sulphite liquors, he recognizes in lignin the presence of two compounds: *alpha*- and *beta*-lignin. To *alpha*-lignin (or acrolein lignin) he gives the formula where



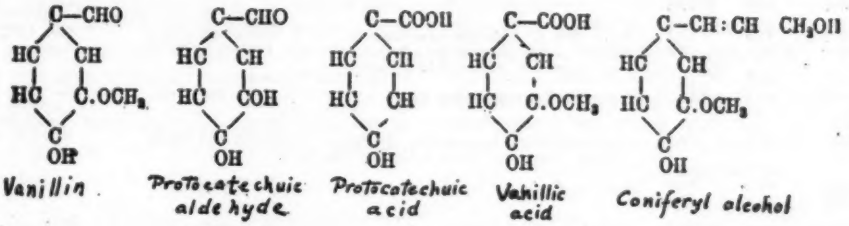
we see the pyrone ring (as in the formulas of Cross and Bevan, of Dorée and of Cunningham), oxyconiferyl aldehyde (where two hydroxyls are replaced by one acetyl and one methoxyl), and one ketone group. This *alpha*-lignin is represented as important for the sulphite digestion process on account of the acrolein remnant in its side-chain, but we already saw how feeble Klason's proofs are of the aldehyde nature of his lignin. In *beta*-lignin or carboxyl lignin there is no aldehyde group but there is a carboxyl perhaps as an ether.

This changing from one formula to another and then to a third within a short time, the formulas having little in common, indicate the weakness of the evidence in favor of any of them. Besides, the number of methoxyls, acetyls and hydroxyls in Klason's lignin do not at all agree with the findings of other investigators.

The presence of *alpha*- and *beta*-lignins in sulphite liquors is also recognized by A. Cleve v. Euler,[85] who assigns to *beta*-lignin the formula of keto-carbonic acid, whose composition is



related to the tannin substances of the conifers:
i. e., Klason and v. Euler suppose that in *beta*-lignin instead of coniferyl aldehyde there is the corresponding acid (because of the replacement of the remnant of acrolein in the side-chain with a part of acrylic acid). However, this supposition is based upon reactivity with *beta*-napthylamine, which is more than doubtful, as we already saw.



Other investigators of lignin have refrained from building structural formulas for lack of sufficiently definite data.

We saw what a variety of formulas are offered, not only structural, but even empirical; therefore, we must consider sceptically the possibility of arriving at present at a structural formula that is at all close to the constitution of the *natural* lignin.

Liesche's Triaxial Diagram

In one of the published works of Liesche[86] we find an attempt to compare the formulas of different authors by means of a

[83]

	C	H	O	Mol. Wt.
Coniferyl alc. formula	66.67	6.66	26.67	180
Klason found	66.14	6.49	27.37	236

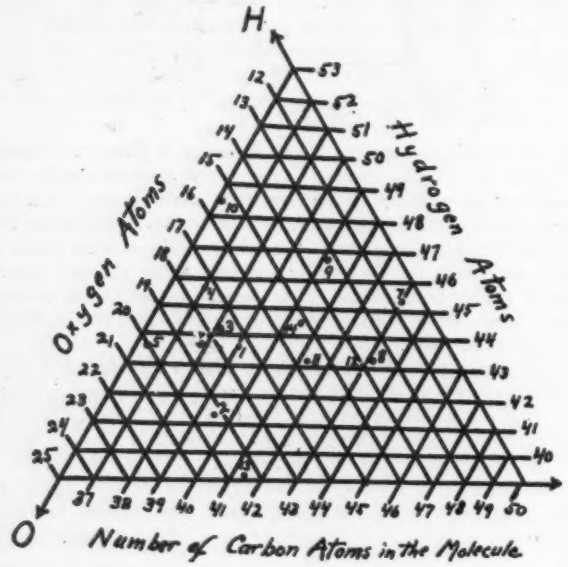
Klason explains the difference in mol. wt. by the ability of coniferyl alcohol to undergo condensation.

[84] Melander. Z. f. Ang. Ch. 1924. No. 13, s. 173.

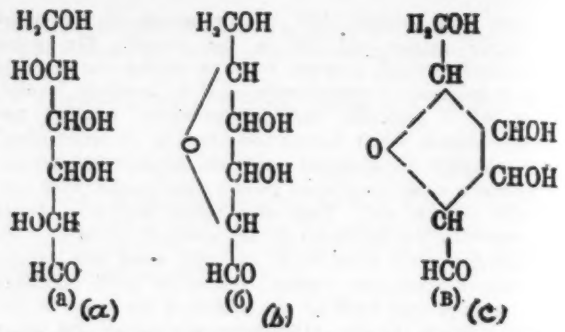
[85] It is worth noting that since none of the proposed theories are definitely proven, each one is of national rather than of scientific significance. Thus Klason's theory is accepted in the Scandinavian countries, the theory of Cross and Bevan, and of Doree and Cuningham in England and America; in Germany they insist upon the aliphatic origin of lignin and upon carbohydrates in the constitution of the latter; finally, Switzerland, the land of neutrality, is neutral also on this question, maintaining that the time is not yet ripe for accepting one view or another (Karrer, Pictet).

[86] Liesche. Z. f. Ang. Ch.

triaxial diagram. Along the base of the triangle are laid off the percentages of carbon atoms in the lignin molecule, while on the sides the corresponding oxygen and hydrogen percentages are laid off. In the middle of the diagram the author shows the position of the formula he derived (C40 H44 O15); the other circles correspond to the formulas of other authors.

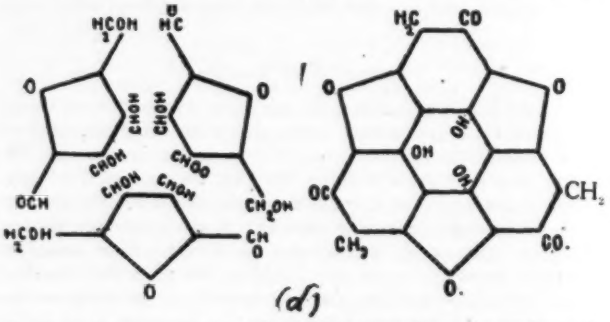


This diagram shows still more clearly how many structural formulas could be built from the available analytical material and how little has been accomplished. And yet Liesche has far from exhausted the available material. The accompanying table gives the data from which the diagram was constructed.



Glucose (a) loses a molecule of water and is bridged with an oxygen (b); Schrauth writes this so as to bring out the furan ring (c).

Three of these molecules lose six particles of water and combine into the complex basic lignin group (d) of the formula C18 H18 O9. Due to the reducing life processes of the plant



the three inner oxygens gradually disappear from the nucleus of this new molecule and we get a hydroaromatic compound of the composition C18 H18 O6.

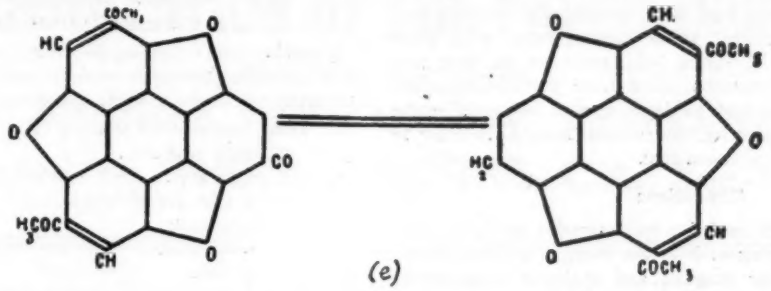
No.	Formula	Calculated atomic per cent C	H	O	Source and Method of Treatment	Investigators	References
1	$C_{20}H_{22}O_9$	39.1	43.5	17.4		Frémy, Terreil, Urbain	Lindsey, Tollens. Ann 267, 341 (1892)
2	$C_{19}H_{20}O_{11}$	39.4	41.5	19.1	From jute by chlorine treatment	Cross and Bevan	Soc. 55. 213 (1889)
3	$C_{20}H_{20}O_{11}$	38.2	44.1	17.7	Sulphite lignin, pptated. with lead acetate and separated with sulphuric acid	Lindsey u. Tollens	Ann. 267, 341 (1892)
4	$C_{20}H_{22}O_{12}$	37.2	45.7	17.1			
5	$C_{20}H_{24}O_{11}$	36.4	43.6	20.0	From wood decomposition data	Cross and Bevan	Soc. 103, 685 (1913). Researches on Cellulose, 398 (1912). Heuser u. Sieber
6	$C_{18}H_{18}O_9$	38.0	44.0	18.0	Calculated from composition of chloro-lignin from jute after deducting four Cl.	Cross and Bevan	Z. anorg. 26.1: 801 (1913)
7	$C_{20}H_{22}O_{11}$	43.0	45.2	11.8	Sulphite lignin	P. Klason	C. 1908, 11, 1302
8	$C_{20}H_{20}O_{10}$	43.2	43.2	13.6			
9	C—65.1 % H— 6.33% O—28.57%	40.2	46.5	13.2	Analysis of ligno-sulphonic salts	H. Seidel	Z. f. ang. 13.11.951 (1900)
10	C—59.6 % H— 6.7 % O—33.7 %	36.2	48.4	15.4	Analysis of ligno-sulphonic salts	Streeb	Diss. Götingen 1892
11	$C_{20}H_{28}O_9$	41.4	43.:	15.5	From analytical data in the literature	Fellenberg	C. 1917, 1, 1154
12	$C_{20}H_{22}O_7$	43.1	43.1	13.8	Fir lignin, lignin—sulpho-calcium salt	P. Klason	Ber. 53, 1864 (1920)
13	$C_{20}H_{30}O_9$	41.2	39.1	19.6	Fir lignin	P. Klason	Ber. 53, 1864 (1920)
14	$C_{20}H_{44}O_{22}$	40.-	44.	15.2	Straw lignin, by the action of alkali in CH_3OH solution	F. Lehmann	Z. Ang. Ch. 34, 285 (1921)

The Hypothesis of W. Schrauth

Remembering the fact that glucose, when acted upon by strong acids under certain conditions, yields 5-oxymethylfurfural with the formation of a furan ring by uniting through an oxygen bridge the two ante-end carbon atoms of the glucose molecule, Schrauth supposes that three glucose molecules changed in this manner can by further splitting off of elements of water unite into one molecule, which would now bear the nature of a polycyclic aromatic compound with 3 furan rings. The progress of the synthesis of such a molecule is as follows:

This molecule, having 3 of the $CO\text{-}CH_3$ combinations in proximity, should, in the opinion of Schrauth, possess considerable reacting ability. For example, it can easily pass into a phenol form and then, as a consequence, be able to form ethers. In this manner it can easily form a molecule with three methoxyls or acetyls and can also combine with ordinary carbohydrates or polysaccharides. Oxidation of this molecule should cause a splitting of the group $CO\text{-}CH_3$ and the formation of hydroaromatic humic acids, such as Schrader obtained by the oxidation of lignin. Through stronger oxidation the dissolution will reach the main nucleus and benzene-polycarbonic acids will be formed,

just as in Fischer's oxidation under pressure. Reduction should yield hydroaromatic hydrocarbons, such as Willstätter and Kalb obtained from lignin. As hydroaromatic ketones, such molecules should easily undergo condensation forming still larger complexes, such as, for example, the one shown by (e) with four methoxyls and a double bond. Hydrolysis with concentrated HCl



(e)

may replace the double bond with the elements of the acid, thus forming a compound of the formula $C_{20}H_{18}O_{11}Cl$, the constitution of which corresponds to the compound obtained by Fischer and Schrader through such a hydrolysis, where of the 22% methoxyls in the natural lignin only 13.1% was left.

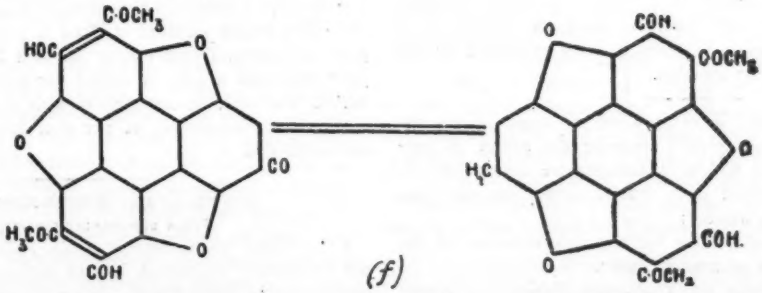
	C	H	OCH_3
Schrauth calculated from his structural formula	64.98%	5.75%	13.3%
Fischer and Schrader found	64.79%	5.65%	13.1%

Apparently, the agreement is almost complete. Furthermore, by attaching calcium bisulphite to his compound, Schrauth gets the formula $C_{20}H_{18}O_{11}S_2Ca$ or $C_{20}H_{14}O_{11}S_2Ca$ depending whether the single molecule (d) or the condensed molecule (e) enter into the reaction through the hydroxyls. In his opinion, a comparison of these formulas with the empirical formulas of Klason and of Hönig and Spitzer shows much similarity.

	% C	% H	% O	% S	% CaO	% OCH_3
Formula $C_{20}H_{18}O_{11}S_2Ca$ requires	52.26	5.04	31.35	6.98	4.37	13.51
Formula $C_{20}H_{14}O_{11}S_2Ca$ requires	53.30	4.93	30.20	7.12	4.45	13.78
Klason found—1	53.78	4.95	31.77	6.35	4.15	12.87
Klason found—2	53.20	4.73	31.26	6.57	4.24	....
Hönig and Spitzer found—1	54.09	5.14	29.84	6.73	4.20	11.66
Hönig and Spitzer found—2	53.34	5.24	31.02	6.40	4.00	12.16
Hönig and Spitzer found—3	52.89	5.10	30.92	6.83	4.26	12.07

The variations here are much larger; however, the data of other authors agree no better, which is unavoidable when working with sulphite lignins, as I have already pointed out. On the other hand, he again gets almost complete agreement with the figures of Beckmann and Liesche.

He obtains the empirical composition of lignin as found by these investigators by replacing four hydrogens in his combined molecule with four hydroxyls, *i. e.*,



(f)

	C %	H %	O %	OCH_3 %
Schrauth's structural formula requires	62.97	5.55	31.48	16.27
Schrauth's structural formula requires	62.80	5.80	31.40	16.22
Beckmann found—1	62.85	5.62	31.53	14.85
Liesche found—2	62.62	5.78	31.60	15.81

Thus we see that Schrauth's hypothesis, which assumes a polycyclic nucleus in lignin, apparently, satisfies the empirical data relating to the constitution of lignin as obtained by several investigators; on the other hand, it bridges the gap between the formation of the first, purely carbohydrate layer of the cell wall and its consequent lignification with the formation of aromatic dissolution products when this lignified cell decomposes. The derivation of a connecting link between the simple carbohydrates, which are the products of the unceasing life processes of the plant organism, and the aromatic substances of the lignified cell seems to have been the main problem that fascinated Schrauth, especially after Schmidt's work supposedly showed lignin to consist principally (70%) of polysaccharides. The polycyclic compound formed from monosaccharides can, in his opinion, serve as an intermediate step to the formation of polysaccharides.

Nevertheless, although Schrauth's formula agrees with the empirical data of other investigators, we cannot regard it otherwise than as a beautiful original hypothesis. So far he is only an experienced formula builder. It will require many experimental data and subsequent synthesis in order that this beautiful structural skeleton may be covered with living flesh. There are too many suppositions in the structures of Schrauth. When it is necessary to get rid of the excess of oxygen in his hydroxyls, he calls upon the reducing powers of vegetation processes to help him;[86] on the other hand, when it is necessary to come closer to Klason's formula for *alpha*-lignin, then in order to hitch on the lacking oxygen and to replace a ketone with a carboxyl, he turns to the "oxidizing action of plant life."[87] The assumed reactions wherein OH, OCH_3, Cl, HCl and Ca $(HSO_3)_2$ are attached to his double or, even, single molecule may take place altogether in a different manner. Finally, when one is dealing with such a large molecule (mol. wt. 700-900), consisting of many benzene rings, it is not difficult to find the combinations for attaching the side-chains so as to obtain the corresponding empirical constitution. Observe that Powell and Whittaker's lignin does not fit into Schrauth's structure.

This hypothesis appeared only a few months ago and has the same object in view—to connect the primary carbohydrate foundation of the cell wall envelope with the aromatic structure of the lignified cell. For a connecting link Strupp employs cycloses,

[86] Z. f. Ang. Ch. 1923. No. 21, s. 150.
[87] Z. f. Ang. Ch. 1923. No. 21, s. 151.

i e., sugars or alcohols of a closed cyclic structure. These cycloses are not uncommon in the vegetable kingdom. Thus, pinene-methyl ether of d-inosite is found in the pitch of Pinus Lambertiana and in the cambial sap of the conifers, although only in insignificant amounts. There were indications that these cycloses can be obtained from the ordinary sugars, and decomposition of cycloses (inosite and others) by oxidation almost always yielded derivatives of benzene, quinone, hydroquinone, pyrogallol, protocatechuic acid, and fusion with KOH-phenol gave quinone, pyrocatechin. These facts together with other material found in the literature led Strupp to the idea that cycloses are the chief elements which form the hydroaromatic cyclic nucleus of lignin and he is at present occupied in the Darmstadt laboratory gathering experimental material in order to give his hypothesis a firm foundation.

Conclusions

1. The drastic methods used for the separation of lignin from wood prevent the obtaining of it in the form in which it occurs in nature. With weaker reagents and at lower temperatures (Powell and Whittaker, Bergmann and Liesche) more reactive lignins were obtained, *i. e.*, more like the natural lignin. Willstätter's and Klason's lignins are strongly polymerized, are considerably deprived of their reactive ability, and cannot, therefore, be used to reconstruct the natural lignin. Not until we find some more careful method for the separation of lignin shall we be able to determine its structure.

2. The available data speak with sufficient reliability for an aromatic central nucleus of lignin. The number of hydroxyls, methoxyls, aldehyde and ketone groups in the natural lignin could not be determined with sufficient exactness.

3. Lignin and the carbohydrates are, apparently, chemically united. A small part of these which is easily removed by a short extraction with water, alcohol or other organic solvents is in an adsorbed condition.

The strength of the reagent, the temperature and other physical conditions of hydrolysis determine the line along which the wood complex is split.

4. The hypothesis of Schrauth and Strupp are nothing more than beautiful attempts to explain the formation of the aromatic lignin nucleus from hexoses and cycloses and, so far, do not rest upon any substantial foundation.

Even if Schrauth should succeed in synthesizing a compound corresponding to his hypothetical formula and to existing empirical data, still there would be no justification for asserting that the structure of the natural lignin is what he claims it is. Only a parallel comparison of the reactions of addition and decomposition of the natural lignin and Schrauth's synthetic lignin will assure us that they are identical.

After the work of Hägglund it is hardly necessary to incorporate furans into Schrauth's formulas since the formation of furfural on acid hydrolysis of lignin is fully explained by the presence of arabinose in the complex.

This article was already in print when we came across the work of C. Dorée and L. Hall[m] studying the action of free sulphurous acid on wood and at a temperature below 110° C. This interesting investigation gave results supporting our conclusions in many respects, namely:

1. Sulphite lignin is not suitable for the determination of the composition and structure of natural lignin.

2. Contrary to the opinion of Wislicenus, lignin is a homogeneous and definite chemical compound.

3. Lignin of the conifers possesses a hydroaromatic polycyclic nucleus partly resembling in structure Schrauth's benzophenanthrene.

4. The oxygen atoms in the lignin molecule are not in the position suggested by Schrauth (furan rings), but are present in the following side-chains:

$C_nH_{2n}O_2$ (SO_3H) $(OH)_2$ (CH_2OH) $(CHOH)$ (CHO) (OCH_3),

Evidently these results strengthen the deductions we made from a comparison of the available material relating to the composition of lignin.

[m] Journ. Soc. Chem. Ind. 43. 257. 1924.

Sulphate Smelting Furnaces

SPECIAL INQUIRY No. 35

A member asks regarding the design, construction and operation of the smelting furnace in sulphate pulp mills and give an outline indicating the details he wishes covered:

A. Brief description of smelters (if convenient attach sketch):
   - a. Single or double.
   - b. Inside area.
   - c. Capacity per 24 hours.
   - d. Blowpipes:
     1. Number.
     2. Size.
     3. Location.
     4. Average air pressure.
     5. Angle toward bottom and spout.

B. Materials used:
   - a. Arch.
   - b. Side wall.
   - c. Bottom.
   - d. Flue.
   - e. Spout.

C. Life of smelter materials:

In all cases actual running time; also include information regarding thickness of materials and size, means of holding smelter to shape, any insulation, or combination of materials and *bond* used.

This inquiry will be handled under the Service to Members Plan and a transcript of replies, in blank, will be sent to all members who respond with information. Send replies to

W. G. MACNAUGHTON,
Secretary, TAPPI,
18 East 41st st., New York.

Pulp Market Satisfactory in Sweden

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 23, 1925.—A report from Consul J. F. McGurk, Helsingfors, states that the pulp and paper market is considered satisfactory. The demand has continued active in both chemical and mechanical pulps and many of the groundwood mills have received orders for shipments during 1926. Great Britain and the United States have been the principal purchasers of chemical pulps. Easy bleaching sulphite for the British market has been quoted at approximately $3.15 to $3.26 and strong sulphite and strong sulphate at $2.82 to $2.93, per 100 pounds. Exports of chemical pulp during the first 10 months of the current year registered a gain of only 8 per cent over the corresponding period last year, in comparison with a gain of 28 per cent for mechanical groundwood, 21 per cent for paper, and 68 per cent for cardboard.

Brown-Graff Warehouse Burned

[FROM OUR REGULAR CORRESPONDENT]

KALAMAZOO, Mich., December 23, 1925.—The Brown-Graff Paper Company's warehouse, located in Grand Rapids and owned in major part by Samuel and Esidore H. Graff, of this city, suffered a $20,000 fire loss Saturday night. Firemen confined the flames largely to the third floor, but large quantities of water caused damage to stock on the lower floors. Jos. Brown, Grand Rapids, is president of the company, with Samuel Graff, secretary-treasurer, and Esidore Graff, vice president. The fire damage will be repaired and the business continued as in the past.

Section of the

COST ASSOCIATION OF THE PAPER INDUSTRY

Affiliated with

THE AMERICAN PAPER AND PULP ASSOCIATION

Conducted by THOS. J. BURKE, C.A., Sec-Treas

Cost Accounting and Foremen's Departmental Activities*

By T. M. McNiece, Union Carbide & Carbon Corp., New York

In presenting these ideas on the relationship between cost accountant and foreman, the point should be strongly emphasized that, in the author's opinion, ideal methods and practices have not been reached yet. On the contrary, there is constant striving to strengthen the weaker elements of the plan as they may develop and to present to the operating management any new combinations of data that will improve their control of plant operations. It is a constant aim to keep ears to the ground and eyes everywhere.

In order that there may be no uncertainty regarding the position taken, let it be said that not only is it believed that all data should be shared with the foreman, in so far as such data concern his operations, but that these data cannot be comprehensively and accurately collected without his active assistance. For this assistance to be effective the foreman must understand what the management wants and just as truly must it understand what the foreman wants.

Early Development Work

While the system of accounts used is considered basic in its application to our factories, you may be assured that its details were not worked out on a glass-covered mahogany desk. On the contrary, during all phases of the early development work, foreman, superintendents and accountants co-ordinated their efforts to solve the difficulties in local application. Conferences were held and are still held which are attended by representatives of all plants interested in this work. Definite programs are provided through the assignment of topics for discussion and questions are referred to committees for decision and answer.

As a matter of information, it should be stated that there are approximately twenty factories working under the same general method and standardized operating accounts. The variety of products made by these plants is very extensive. It includes on the one hand products in continuous process of manufacture and on the other hand products made in small job lots according to definite specifications from customers. The nature of these products is equally variable and embraces storage batteries of all types, dry cells, radio and flashlight batteries, chemical products—liquid and gaseous—calcium carbide, welding and cutting apparatus, a complete line of carbon products from electric furnace electrodes two feet in diameter and ten feet long to the minute carbon granules used in telephone transmitters, and a large variety of ferrous and non-ferrous alloys.

All of the factories producing these products keep their own operating accounts and forward to the central office each month a plant balance sheet together with certain standard auxiliary operating reports. Expense accounts or classifications are listed in a uniform manner for all plants and the direct charges are arranged to meet the requirements fixed by product, plant arrangement and organization.

The Operating Man's Point of View

In arranging the schedule of accounts, effort has been made to keep in mind particularly the operating man's point of view and to collect the figures in those groups or classifications which will enable him best to control his expenditures. In the main, the two prime objects of the accounting schedule are: (1) To ascertain cost of operation, and (2) To ascertain cost of product.

It should not be assumed that the order in which these objects have been placed constitutes heresy of a degree that is indefensible. The need for prompt and accurate product costs is not in any way underrated, but the value to plant executives of clearly stated operating costs as a means for producing further economies is the point particularly emphasized. Experience has shown positively and beyond doubt that an active, aggressive and logically thinking technical, engineering and operating staff may be relied upon to effect consistent economies in co-operation with the cost accountant on items included in the divisions of direct material and direct labor. The element of expense, however, is usually nobody's "pet" and it is here that a fundamental classification of expense charges must be vigorously applied. Properly used, this classification will permit the operating executive, manager, superintendent and foreman to keep the "undertow of unclassified detail from submerging the overhead to a depth where it defies examination and analysis," in terms of a trenchant phraseology recently noted.

To win and maintain a foreman's interest and active support in the collection and use of statistical data, such data must mean something to him, and to mean the most to him, they should enable him and others to measure his own performance and progress.

Divided Into Manufacturing Departments

Therefore, each factory is divided into manufacturing departments according to its layout and the processes involved in fabricating its products. These departments also coincide with the field of the foreman's authority and responsibility, although, of course, a foreman or general foreman may sometimes exercise supervisory control over more than one department.

There are also certain auxiliary or service departments—non-manufacturing departments—in each plant, and these, too, are un-

* From N.A.C.A. Bulletin.

der the control of foremen or departmental heads. Examples of such departments are Power, Employment, Maintenance, Superintendents, Buyers, etc. All such activities are classified in a standard way for all plants.

In addition to this there is also a standard list of accounts or charges where the element of personnel is not involved. Included in this group, for example, are Fixed Charges.

All manufacturing department charges are divided into direct and indirect classes. The direct charges are further divided into direct material and direct labor while the indirect or departmental charges —those occurring in the department itself—are divided into a classification that is standard for all manufacturing departments.

Direct material is that which finds its way into the product and becomes a part of it at some stage or another.

Direct labor expended in manufacturing operations upon the product itself. Where advisable, this is further subdivided within the department to individual operations.

Departmental Expense

Departmental expense consists of the indirect charges encountered within the department for its own operation. This is classified in a standard way for all departments and plants and displays separately such basic charges as supervision, inspection, maintenance, reclamation of errors, supplies and other important charges. These divisions, we maintain, are fundamental in that they represent the prime causes for the expenditures and for that reason the control is maintained in these same divisions.

All auxiliary and service department charges are classified in the same way as those departmental expense charges just described.

The manufacturing departments are charged each month upon either a metered or an engineering basis for heat, light, power and water. These costs have previously been collected for control purposes in the auxiliary groups and the net residue of auxiliary and fixed charges after subtracting those just mentioned is allocated to the manufacturing departments by several methods which have been adopted as standard. These amounts are separately displayed on the departmental reports so there is no confusion with the departmental charges.

Direct material and direct labor charges are of course further divided within each department, to products and types of product suitable manufacturing order or cost schedule numbers and collected in this manner for purpose of determining product cost.

Expense is applied to product costs departmentally on a direct labor basis.

In the manner thus briefly described, cost of operations and cost of product are collected by departments for the operation of which definite individuals or foremen can be held accountable.

Statistics From Original Entries

At this point, it will be well to mention that the statistics come from the original entries made on stores issues, time cards, production records, etc., and when collected and summarized form the debits and credits to the various operating accounts. In other words, these operating data are secured step by step as the reports are summarized and the completed results are not analyzed, as is sometimes done, in order to determine what division of charges shall be displayed on the reports. In this way, 100 per cent of the expenditures are definitely accounted for in the operating reports furnished to the department heads.

It is our belief that the divisions of operating charges indicated are basic or fundamental and are common to practically any form of manufacturing enterprise. Furthermore, by maintaining the control of these charges in the same fundamental classes in which they occur, manager and foreman alike are provided with the most effective means for holding them within proper bounds and reducing them where further economy is feasible.

It may be well to mention briefly the organization of the group that is responsible in each factory for the collection of data and administration of accounts and costs. This division is designated by the term, Manufacturing Office, and the executive in charge is called the Head of the Manufacturing Office. He is responsible to the superintendent as far as daily activities and personnel are concerned, but the methods of procedure are outlined by the General Accounting Department in the Central Office. This central control is absolutely essential in order to maintain the benefits of standardized practice.

Under the jurisdiction of the Head of the Manufacturing Office is the control of stores, time-keeping, material and labor distribution, cost-keeping, book-keeping, factory invoicing, production records and, in some factories, planning and shipping.

In this manner, responsibilities are clearly set forth and the collection of all data affecting the accuracy of the monthly records is subject to the control of one man whose chief item of business is to see that this work is properly and promptly done. This man then becomes the chief interpreter, as it were, of the results of the factory operations and, therefore, works very closely with the superintendent.

What Results Are Obtained?

Now that the organization and procedure have been outlined in this sketchy manner, it may well be asked what results are obtained therefrom. To indicate that, we have three report sheets in as many colors which are provided each month at each factory. The brown or buff sheet shows the operating expenditures for all auxiliary or service and business departments, and all accounts of a general nature including fixed charges.

The departmental and account symbols are listed along the left and right margins while across the top are listed the classified departmental expense accounts, as, for example, supervision, maintenance, supplies, miscellaneous labor, etc. For purposes of comparison, last month's total and the total of the year-to-date are shown side by side with the column showing totals by departments.

Similarly at the bottom of the sheet are the totals for the current month, last month, and year-to-date of the same expense divisions for all departments.

The blue sheet is made up in exactly the same way but includes only the manufacturing departments.

The white sheet is a complete summary of charges to operations and in addition to showing the departmental and allocated expense by departmental totals also shows the direct material and labor charges by departments.

The reports in this form do not go to the foreman as they cover operations for the whole plant.

There is also a departmental report upon which is recorded in detail the charges against the department and the source of the charges as well as departmental expenditures for the account of any other departments. Each foreman thus gets a complete statement of each month's operations of his own department. The foreman is heartily encouraged to come to the manufacturing office at any time to ask for justification and proof of charges in case he feels an error has been made. Stores issues and time cards are filed in such a manner as to be available for ready reference and accuracy or inaccuracy of charges can be easily determined. In general the foreman is the only one aside from the maintenance foreman who is permitted to initiate charges to his own accounts.

More Valuable in Comparative Form

Data of this type are much more valuable when posted in comparative form in such a manner that tendencies upward or downward can be detected at a glance. Accordingly, there is used a statistical sheet 8½ x 11" in size with months listed along the left margin and across the page a series of vertical columns without headings. Headings suitable for the need can be inserted and the data transferred to this sheet from the monthly form. As a rule, it is good practice for the foreman to make this transfer. It requires an almost negligible part of his monthly time and the very act of recording will force a consideration which the data might not otherwise receive. Space is provided on this statistical sheet

for two years' records, including totals and average for the year. On the back of the sheet is imprinted a cross-section ruling which permits any essential or major data to be recorded graphically. We believe, very strongly in the advantage of graphical display of many kinds of data. Of all the five senses, seeing is the one which most quickly responds to an impression. The Chinese sage, Confucius, is credited with saying, "One picture is better than ten thousand words."

While as previously stated these results are best displayed in comparative form, they become still more valuable if some standard bogie can be adopted as a unit by which to measure actual performance each month. In a number of plants, this has been done. In collaboration with the foremen and departmental heads, the manufacturing office and the superintendent have established and agreed upon certain amounts in direct labor and in each of the divisions of expense as sufficient to operate the plant at its standard capacity. These are effective for the current year. In the same way and in the same form standards have been developed by some ten of the factories. It may be well to mention specifically that the standard methods have necessarily not attained the same degree of development at all of the factories using them. Installation and parallel development cannot be carried on simultaneously at so many widely separated points.

The standards or bogies, to which reference has been made, are entered at the top or bottom of their respective columns on the statistical reports referred to above, and are therefore, available at all times for comparative purposes. There are not many foremen who, once entering into the spirit of the plan, will not exert every effort to meet the figures agreed upon and who having met them will not continue the pressure to reduce them and beat the commitment.

The records mentioned up to this point are monthly and are ordinarily available to the foremen sometime between the 9th or 10th and the 15th or the 16th of the month, according to the size of the plant. In addition to the expense charges by detailed divisions, material and labor charges together with production are furnished. In the case of a single product, the division of each of the classes of charges by the production immediately makes a series of per unit values available as far as his own department is concerned. It follows without argument that this should be a most effective aid in the control of departmental operations.

More Up-to-the-Minute Results

In a very large proportion of our plants, a demand has arisen among the foremen and other executives for more up-to-the-minute results than those just described. In some factories, certain data have been requested daily and arrangements have been made that will enable the foremen to secure certain labor statistics for control purposes on the day following the expenditure. Other data are supplied weekly in a manner that means very little additional work. A number of the statistical sheets described, sufficient to carry the data desired, are clipped together in a folder—one for each department. The foremen retain possession of these booklets until a given day of the week, when according to instructions, typewritten on the cover, they return them to the Manufacturing Office where the figures for the prior week are inserted. The sheets are immediately returned to the foremen who keep them until they are again to be returned. Anything within reason that will encourage the use of such information while it is still "hot" cannot be too strongly recommended. Such information is of relatively little value for merely historical purposes. On the other hand its value increases enormously as it is currently used.

Co-operation of the Foreman

It may very properly be asked what procedure is followed in securing the interest and co-operation of the foreman. There is no definite formula that can be made to fit all cases. In undertaking the introduction of operating and production cost data to the foremen the first aim is, by group or individual contact or both, to acquaint each foreman with the nature of the material and labor charges peculiar to his department and the reasons therefor. It has frequently happened that valuable and timely suggestions have been received from the foreman at this or a slightly later stage. If the foreman and others can be taken into partnership, as it were, it will not only increase the breadth of view of all parties interested, but will arouse in the foremen some interest in following the results of their own suggestions. These things usually work out to the mutual advantage of all concerned.

In this discussion with the foreman, he is reminded that he initiates many of the changes placed on stores issues and time cards and that it is by the summarized results of these that his performance may in part be judged. It may also be suggested to him that his signatures on stores issues and time cards are essentially the same as far as final results are concerned, as his signature on the company's check for an equivalent amount of money. Since this is true and since he initiates such charges, it is strictly up to him in the interest of the company and of himself to see that such charges are fairly and accurately made according to plans furnished him. It follows that those responsible for acquainting the foreman with the requirements must do their job well and supply the foreman with all the information the case demands. Too frequently this part of the work may be slighted.

It may be pointed out to the foreman that it is he who is doing the primary accounting and that the clerks and bookkeepers in the office are merely busied in arranging and accumulating the charges he has already made.

It is not often that foremen are averse to receiving and utilizing the data pertaining to their departments, and therefore, in helping to collect the data accurately. If such a case is encountered, the foreman's attitude may not be entirely his fault but the result of earlier training or environment. It may also be that prejudice has been aroused by some unfortunate and mistaken application of similar information at some previous time.

It is quite the natural thing for a foreman to feel that if he has turned out his product in the desired quantity and quality, he has fulfilled his mission. Under such conditions, he gladly leaves consideration of costs to others. Such a foreman sees about him every day masses of product in pieces, pounds, gallons, yards or other unit, until he loses sight of all but product. In such cases, it is pointed out to him that while his plant and department are equipped to manufacture product, this is only a means to an end and that end is profits; that maximum profits demand minimum costs; and that unless he is constantly using his influence directed by data supplied him to reduce costs, he is not playing his full part in the game. In following up this thought, emphasis is placed on the importance of appraising his performance and progress in the same units of measure as used by the management in judging the final results, namely, dollars and cents.

To Overcome Lingering Prejudice

To overcome successfully any lingering prejudice which a foreman may have for the use of any cost figures, it is essential that those who come in contact with him be prepared to meet him on his own ground, be familiar with his product and problems and be able personally to inspire his respect. The tabulations presented must be correct within the limitations prescribed by his own inaccuracies. Nothing will confirm a foreman more quickly in his belief that the use of costs is worthless, than to find them inaccurate when he does investigate them.

One of the best methods within our experience in securing favorable attention and action from the foreman, and one which is followed in a large number of factories, is the custom of the superintendents to call upon each foreman once a month for a review of his operating charges, an explanation of any major variations, and definite recommendations for any economies where it is feasible to make them.

On certain major products, cost sheets are furnished by the

plant, showing the cost of each material involved, each labor operation and its corresponding expense. These values are sub-totaled by departments. Where more than one plant is engaged in the manufacture of such products, these costs are displayed by the central office in parallel columns by factories and a copy of this composite sheet sent to each superintendent whose plant is engaged in the manufacture of the product. Since these costs display the departmental detail, each superintendent is enabled to compare his costs in detail, by operations and departments, with those of the other factories. The management, in turn is able to match the lowest costs in any detail at any of the plants with the cost of the same operations at the other factories and either to justify the differences or to take steps to reduce the higher costs to the lower levels attained. This indirectly comes back to the foreman and has the distinct advantage of encouraging the element of friendly, inter-plant rivalry.

If a foreman, superintendent, or for that matter, anyone of us finds that he is to be judged in accordance with some definite plan, he will not long postpone the time when he will take active interest in the method used.

There is a habit or fashion of work in every plant and it is in the main dictated by the superintendent or other active executive. As the superintendent plans, so must the others work or ultimately fade out of the picture. If, therefore, the foremen characteristically fail to measure up to reasonable expectations, it may pay to spend some time with the superintendent or manager.

Reclamation of Errors Account

One of the most profitable items for study by the foreman is his reclamation of errors account. Without going into detail regarding it, this account represents the cost of the spoiled work that is scrapped plus the cost of putting such work that can be saved within specifications. The value of setting this cost out clearly from other groups is tremendous. One of our works managers recently advised that in furnishing graphs to his foremen, he has chosen green ink for the Reclamation of Errors account. Those familiar with the intricacies of the Grand Central subway station, will appreciate the slogan the foremen have chosen, namely, "Follow the Green Line."

To express briefly the burden of this discussion: make an honest effort to display the facts and having displayed them, have them put to profitable use.

A few days ago, Mr. Owen D. Young, of the Dawes Commission, in a speech on international relations, given at the time a degree was conferred upon him by Johns Hopkins, made the following remarks regarding the use of facts:

"Facts can be applied in any field. Our curse is ignorance. Facts are our scarcest raw material. This is shown by the economy with which we use them. One has to dig deep for them because they are as difficult to get as they are precious to have."

How literally this may be applied to the field of endeavor under discussion!

The place to save money is the point at which it is spent, and, technically, it is spent when the foreman signs the time card and stores issue. This, therefore, is one place to display the facts and to use them. Nothing is gained by preventing the proper use of facts through concealment.

Concealment amounts to censorship which works both ways; that is, it may be applied from below as well as from above. It is our policy to present the facts in such a way that all who should have them will have all they should have and may be guided accordingly.

An Editorial From Collier's

Some years ago there appeared an editorial in *Collier's* that seems to apply to this situation:

"Somewhere in Holland a certain elderly civilian, his 120-odd uniforms laid aside, is growing a beard, taking walks in the castle garden, cutting wood for the fireplace from logs respectfully handed to him by liveried attendants, and is otherwise generally busied looking after the health of the person he cares most about. He receives a good deal of mail, but as the Associated Press Dispatch states: 'A servant of the former Emperor inspects the letters and permits only those communications which he considers will please him to reach the royal exile.'

"There you have censorship at its silly worst. If it affected only exiles, the matter would not be very important. But eminent and busy men in all walks of life miss true leadership by doing much the same thing. They try to save time, to make things go smoothly, and it finally comes out that some one else determines what facts shall appear before their minds for judgment or action. They do not get the truth; they get what a subordinate thinks they ought to have, and littleness thus grasps power by indirection. No one can master all his facts, but he can make occasionally what the accountants call a "spot check" as HARUN-AL-RASHID did in his midnight prowls around Bagdad a thousand years ago. The instinct for that is one of the proofs of leadership. * * * Censorship is evil because it makes men walk in twilight and between walls."

News Print Production Shows Gain

Production of news print in the United States during November, 1925, according to the News Print Service Bureau, amounted to 130,102 tons, and shipments to 133,199 tons. Production in Canada amounted to 132,148 tons, and shipments to 131,942 tons, making a total United States and Canadian production of 262,250 tons and shipments of 265,141 tons. There were also 11,445 tons of news print made in Newfoundland and 1,036 tons in Mexico in November, so that total North American production for the month amounted to 274,231 tons, and for the first eleven months of the year to 2,866,782 tons. The news print mills also made 1,756 tons of hanging paper, 335 tons of which were made in Canada. Stocks of news print paper at United States mills totaled 17,418 tons, at the end of November and at Canadian mills 21,563 tons, making a combined total of 38,981 tons, which was equivalent to 3.6 days' average production. During November the United States mills operated at 93.7 per cent of capacity and the Canadian mills at 100.6 per cent.

Comparing production during the first eleven months of 1925 with the same period of each of the five previous years the United States mills made 3 per cent more than in 1924, and 2 per cent more than in 1923; 5 per cent more than in 1922; 24 per cent more than in 1921, and about the same as in 1920; the Canadian mills produced 11 per cent more than in 1924; 18 per cent more than in 1923; 40 per cent more than in 1922; 89 per cent more than in 1921, and 72 per cent more than in 1920.

The combined production of the United States and Canadian mills for the first eleven months of 1925 was 7 per cent more than in 1924; 9 per cent over 1923; 20 per cent over 1922; 50 per cent over 1921, and 27 per cent over 1920. There was a production of 83,140 tons in Newfoundland and 11,695 tons in Mexico during the first eleven months of 1925.

Paper Situation Satisfactory in Belgium

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 16, 1925.—Conditions in the Belgian paper industry during October were reported generally satisfactory, the demand being good and prices firm with a rising tendency. The mills were unable to meet all of the demands received from abroad, owing to extensive domestic requirements, especially in the line of semi-fine grades and news print. Paper mills worked at maximum capacity during the entire month, but stocks on hand at the end of October were nevertheless reported very light. Imports of news print and wrapping paper from the Scandinavian countries were regular and large in volume and were readily taken up.

WOOD PULP
AGENTS

PRICE & PIERCE, Ltd.,

17 EAST 42ND ST.,
NEW YORK

H. G. CRAIG & CO., Inc.

Paper Merchants
(Since 1868)

News
Hanging
Tissues
Box Board
Wood Pulp
Specialties
Mill Supplies

17 East 45th St. NEW YORK, N. Y.

Bay West Paper Co.

The "DUBLTOWL" Folks
EXTEND
TO PAPER MERCHANTS EVERYWHERE
SINCERE AND CORDIAL WISHES
for
A HEALTHFUL, HAPPY
AND PROSPEROUS
NEW YEAR

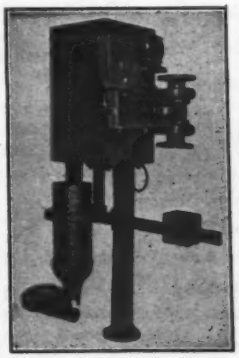
To make it healthful we can do little; to make it happy we can do something, but to make it prosperous we can send you the same samples, price lists and proposition, which started many dealers, in 1925, to realize the prosperity which is begot of satisfied customers, returning again and again for quality products attractively priced.

TOWELS NAPKINS CREPE SPECIALTIES
SANITARY APPURTENANCES

Bay West Paper Co., Green Bay, Wis.

Would you like UNIFORM WEIGHTS?

CERTAINLY!



Do you have them?
SOMETIMES!

Why not use the
"TRIMBEY"
Regulator and have
them—
ALL THE TIME!

More than 400 in use in the paper and pulp mills of North America and Europe.

Full information on request.

TRIMBEY MACHINE WORKS
Glens Falls, N. Y.

"Made in Canada"? Yes.

Imports of Paper and Paper Stock

NEW YORK, BOSTON, PHILADELPHIA AND OTHER PORTS

NEW YORK IMPORTS

WEEK ENDING DECEMBER 26, 1925

SUMMARY

Cigarette paper .....184 cs.
Wall paper .....67 bls., 176 rolls, 2 cs.
Paper hangings .....371 bls., 2 cs.
News print .....8858 rolls
Printing paper .....591 cs., 17 bls., 68 rolls
Wrapping .....7 cs.
Packing paper .....113 cs., 37 rolls
Filter paper .....127 bls., 4 cs., 24 cs.
Parchment paper .....13 cs.
Drawing paper .....3 cs., 45 rolls
Decalcomania paper .....18 cs.
Transfer paper .....13 cs.
Colored paper .....15 cs.
Writing paper .....12 cs.
Tracing paper .....22 cs.
Silk paper .....4 cs.
Surface coated paper .....56 cs.
Metal paper .....5 cs.
Baryta coated paper .....50 cs.
Tissue paper .....5 cs.
Photo paper .....3 cs.
Fancy paper .....11 cs.
Stencil paper .....13 cs.
Envelopes .....21 cs.
Paper spools .....34 cs.
Paper tubes .....11 cs.
Paper wrappers .....47 cs.
Straw board .....538 rolls
Miscellaneous paper .82 cs., 61 pgs., 12 rolls, 2 bls.

CIGARETTE PAPER

F. P. Gaskell & Co., Rochambeau, Havre, 20 cs.
P. J. Schweitzer, Paris, Havre, 24 cs.
Standard Products Corp., Paris, Havre, 130 cs.
Standard Products Corp., Waukegan, Havre, 10 cs.

WALL PAPER

A. C. Dodman, Jr., Inc., Majestic, Southampton, 17 bls.
Janeway & Carpender, Republic, Bremen, 176 rolls.
Continental National Bank, Westphalia, Hamburg, 13 bls.
F. J. Emmerich, Westphalia, Hamburg, 28 bls., 4 cs.
Globe Shipping Co., Westphalia, Hamburg, 6 bls.
F. A. Binder, America, Bremen, 3 bls.
Fezandie Sperrle, Paris, Havre, 1 cs.
W. H. S. Lloyd & Co., Paris, Havre, 1 cs.

PAPER HANGINGS

A. C. Dodman, Jr., Inc., Regina, Liverpool, 59 bls.
W. H. S. Lloyd & Co., American Shipper, London, 53 bls., 2 cs.
F. & R. Trading Co., Nitonian, Antwerp, 259 bls.

NEWS PRINT

Parsons & Whittemore, Inc., Hjelmaren, Wiborg, 325 rolls.
Parsons & Whittemore, Inc., Hjelmaren, Kotka, 633 rolls.
H. Reeve Angel & Co., Inc., Hjelmaren, Kotka, 603 rolls.
Tidewater Papermills Sales Corp., Cranley, Botwood, 3971 rolls.
W. Hartman & Co., Inc., N. Amsterdam, Rotterdam, 84 rolls.
New York Times, Humberarm, Cornerbrook, 2914 rolls.
New York Call, Humberarm, Cornerbrook, 328 rolls.

PRINTING PAPER

Maurice O'Meara Co., Republic, Bremen, 32 cs.
Republic Bag & Paper Co., Yaye Maru, Hamburg, 17 bls.
P. Puttman, Zeeland, Antwerp, 12 cs.
H. Reeve Angel & Co., Inc., Hjelmaren, Kotka, 446 cs.
Oxford University Press, Regina, Liverpool, 10 cs.
B. F. Drakenfeld & Co., Regina, Liverpool, 19 cs.
C. Steiner, N. Amsterdam, Rotterdam, 8 cs.
A. Price & Sons, Nitonian, Antwerp, 54 cs.
Keuffel & Esser, Westphalia, Hamburg, 61 rolls.
Perkins Goodwin & Co., Laura C., Trieste, 7 rolls.

WRAPPING PAPER

J. B. Mast & Co., Conte Rosso, Genoa, 3 cs.
H. Reeve Angel & Co., Inc., Nitonian, Antwerp, 4 cs.

PACKING PAPER

F. C. Strype, N. Amsterdam, Rotterdam, 18 cs.
Irving Bank Columbia Trust Co., Zeeland, Antwerp, 37 rolls.
International Forwarding Co., Westphalia, Hamburg, 95 cs.

FILTER PAPER

J. Manheimer, Ausonia, Bordeaux, 127 bls., 4 cs.
H. Reeve Angel & Co., Inc., Ausonia, Bordeaux, 19 cs.
E. Fougera & Co., Ausonia, Bordeaux, 2 cs.
Zinkeisen & Co., Westphalia, Hamburg, 3 cs.

PARCHMENT PAPER

S. Gilbert, N. Amsterdam, Rotterdam, 13 cs.

DRAWING PAPER

Keuffel & Esser, Ausonia, Liberpool, 3 cs.
Kauffel & Esser, Westphalia, Hamburg, 45 rolls.

DECALCOMANIA PAPER

C. W. Sellers & Co., Republic, Bremen, 14 cs.
Phoenix Shipping Co., Republic, Bremen, 4 cs.

TRANSFER PAPER

F. L. Kramer & Co., Republic, Bremen, 13 cs.

COLORED PAPER

Phoenix Shipping Co., Republic, Bremen, 2 cs.
E. Daiber, Zeeland, Antwerp, 7 cs.
C. W. Williams & Co., Nitonian, Antwerp, 5 cs.
Phoenix Shipping Co., Westphalia, Hamburg, 1 cs.

WRITING PAPER

Japan Paper Co., Rochambeau, Havre, 2 cs.
Sternberg & Co., Hellen, Marseilles, 10 cs.

TRACING PAPER

Globe Shipping Co., Berlin, Bremen, 18 cs.
Phoenix Shipping Co., Westphalia, Hamburg, 4 cs.

SILK PAPER

Globe Shipping Co., N. Amsterdam, Rotterdam, 4 cs.

SURFACE COATED PAPER

A. C. Dodman, Jr., Inc., Zeeland, Antwerp, 42 cs.
Gevaert Co., of America, Zeeland, Antwerp, 6 cs.
Phoenix Shipping Co., Westphalia, Hamburg, 8 cs.

METAL PAPER

C. B. Richard & Co., Berlin, Bremen, 3 cs.
Hensel Bruckman & Lorbacher, Westphalia, Hamburg, 2 cs.

BARYTA COATED PAPER

Globe Shipping Co., Berlin, Bremen, 50 cs.

TISSUE PAPER

Meadows Wye & Co., Regina, Liverpool, 5 cs.

PHOTO PAPER

J. J. Gavin, Regina, Liverpool, 3 cs.

FANCY PAPER

Whiting & Patterson Co., Majestic, Southampton, 11 cs.

STENCIL PAPER

Arlac Dry Stencil Co., Westphalia, Hamburg, 13 cs.

ENVELOPES

Globe Shipping Co., Republic, Bremen, 21 cs.

PAPER SPOOLS

J. I. Bernitz, Republic, Bremen, 34 cs.

PAPER TUBES

H. de Maguinn, Rochambeau, Havre, 11 cs.

PAPER WRAPPERS

British American Tobacco Co., Zeeland, Antwerp, 47 cs.

STRAWBOARD

A. Vuyck, N. Amsterdam, Rotterdam, 538 rolls.

MISCELLANEOUS PAPER

Guibout freres, Rochambeau, Havre, 4 cs.
A. C. Dodman, Jr., Inc., Rochambeau, Havre, 2 cs.
Heemsoth Basse & Co., N. Amsterdam, Rotterdam, 61 pgs.
International Forwarding Co., N. Amsterdam, Rotterdam, 12 rolls.
P. H. Petry & Co., N. Amsterdam, Rotterdam, 21 cs.
Keffel & Esser, N. Amsterdam, Rotterdam, 20 cs.
C. E. Sheldon & Co., Majestic, Southampton, 3 cs.
P. H. Petry & Co., Westphalia, Hamburg, 4 cs.
Japan Paper Co., Paris, Havre, 16 cs.
Guibout freres, Paris, Havre, 10 cs.
Kaufman & Strauss, Paris, Havre, 2 cs.
A. C. Dodman, Jr., Inc., Paris, Havre, 2 bls.

RAGS, BAGGINGS, ETC.

Castle & Overton, Inc., Yaye Maru, Hamburg, 37 bls. rags.
C. Bornet & Co., Yaye Maru, Hamburg, 335 bls. rags.
Bankers Trust Co., Yaye Maru, Hamburg, 20 bls. rags.
American Woolstock Corp., Yaye Maru, Hamburg, 3 bls. rags.
S. Birkenstein & Sons, Yaye Maru, Hamburg, 67 bls. rags.
National City Bank, Republic, Bremen, 57 bls. rags.
Mechanics & Metals National Bank, Hjelmaren, Stockholm, 176 bls. rags.
The Stone Bros. Co., Inc., N. Amsterdam, Rotterdam, 43 bls. rags.
M. Maier Paper Mill Supply Corp., N. Amsterdam, Rotterdam, 169 bls. bagging.
American Woolstock Corp., N. Amsterdam, Rotterdam, 139 bls. rags.
P. Berlowitz, N. Amsterdam, Rotterdam, 35 bls. rags.
Castle & Overton, Inc., American Shipper, London, 29 bls. rags.
Castle & Overton, Inc., Eclipse, Hamburg, 84 bls. bagging.
J. M. Jaffe, Orizaba, Havana, 11 bls. bagging.
Anglo South American Trust Co., Westphalia, Hamburg, 72 bls. rags.
Castle & Overton, Inc., Westphalia, Hamburg, 47 bls. rags.
Union National Bank, Westphalia, Hamburg, 42 bls. bagging.
Union National Bank, Westphalia, Hamburg, 100 bls. rags.
Darmstadt Scott & Courtney, America, Bremen, 75 bls. rags.
The Barett Co., America, Bremen, 219 bls. rags.
P. Landrien, Paris, Havre, 103 bls. rags.
Garfield National Bank, Mercier, Antwerp, 188 bls. rags.
Mechanics & Metals National Bank, Hellen, Marseilles, 29 bls. rags.
The Stone Bros. Co., Inc., Hellen, Marseilles, 52 bls. rags.
A. W. Fenton, Inc., Hellen, Marseilles, 101 bls. rags.
Central National Bank, Brazil Maru, Algiers, 190 bls. rags.
E. J. Keller Co., Inc., Brazil Maru, Algiers, 232 bls. rags.
Atlas Waste Manfg. Co., Waukegan, Dunkirk, 100 bls. rags.
Castle & Overton, Inc., Waukegan, Dunkirk, 127 bls. rags.
Minsky & Co., Waukegan, Havre, 77 bls. bagging.
Darmstadt Scott & Courtney, Waukegan, Havre, 56 bls. paperstock.
A. W. Fenton, Inc., Waukegan, Havre, 125 bls. rags.
R. Ingram, Waukegan, Havre, 63 bls. rags.
Chemical National Bank, Anfora, Leghorn, 58 bls. rags.
Royal Manfg. Co., Anfora, Genoa, 28 bls. cottonwaste.
Castle & Overton, Inc., Anfora, Genoa, 95 bls. bagging.
Grace National Bank, Anfora, Genoa, 108 bls. bagging.
E. J. Keller Co., Inc., Anfora, Marseilles, 195 bls. rags.
The Barret Co., Anfora, Marseilles, 66 bls. rags.
Castle & Overton, Inc., Liberty, Havre, 211 bls. bagging.
Castle & Overton, London Commerce, London, 49 bls. bagging.
Castle & Overton, Inc., London Commerce, London, 19 bls. rags.
Castle & Overton, Inc., Cabo Villano, Italy, 66 bls. bagging
E. J. Keller Co., Inc., H. Luckenbach, Shanghai, 365 bls. rags.

OLD ROPE

Brown Bros. & Co., Zeeland, Antwerp, 58 coils.
Brown Bros. & Co., N. Amsterdam, Rotterdam, 73 coils.
Brown Bros. & Co., Republic, Bremen, 100 bales.
British Bank of South America, Regina, Liverpool, 95 coils.
J. M. Jaffe, Orizaba, Havana, 34 bales.

MANILA ROPE

New York Cordage Co., Zeeland, Antwerp, 40 rolls.
Ellermans' Wilson Line, American Shipper, London, 83 coils.
Ellermans' Wilson Line, Majestic, Southampton, 80 coils.
United Fruit Co., Nitonian, Antwerp, 56 coils.

WOODPULP

E. M. Sergeant & Co., Natirar, Hernosand, 2100 bls. sulphite, 350 tons.
Buck Kiaer & Co., Inc., Berlin, Bremen, 300 bls. sulphite, 50 tons.
Tidewater Papermills Co., Cranley, Botwood, 14,797 bls. woodpulp, 2,635 tons.
M. Gottesman & Co., Inc., N. Amsterdam, Rotterdam, 1200 bls. woodpulp.
Tidewater Papermille Co., Bornholm, Liverpool, N. S., 12,231 bls. woodpulp.
Bulkley Dunton & Co., Eclipse, Hamburg, 1300 bls. woodpulp, 260 tons.
Castle & Overton, Inc., Eclipse, Hamburg, 140 bls. woodpulp, 28 tons.
Johanson Wales & Sparre, Inc., Nordlys, Frano, 600 bls. kraft pulp, 101 tons.
Johanson Wales & Sparre, Inc., Nordlys, Kramfors, 600 bls. sulphite, 101 tons.
Buck Kiaer & Co., Inc., Tyrifjord, Oslo, 3200 bls. sulphite, 400 tons.
Nilson, Lyon & Co., Tyrifjord, Gothenburg, 900 bls. sulphite, 152 tons.
J. Anderson & Co., Tyrifjord, Sarpsborg, 1905 bls. sulphite.
Buck Kiaer & Co., Inc., Stavangerfjord, Oslo, 200 bls. sulphate, 25 tons.
Buck Kiaer & Co., Inc., Randsfjord, Hommelvik, 2438 bls. sulphite, 406 tons.
Buck Kiaer & Co., Inc., Stockholm, Gothenburg, 600 bls. sulphate, 100 tons.

WOODPULP BOARDS

Lagerloef Trading Co., Hjelmaren, Kotka, 1041 bls.
Lagerloef Trading Co., Westphalia, Hamburg, 621 bls.

CASEIN

Kalbfleisch Corp., Pan America, B. Aires, 1,167 bags.

PHILADELPHIA IMPORTS

WEEK ENDING DECEMBER 26, 1925

Paper House of Penna., Hjelmaren, Kotka, 41 rolls printing paper.
Paper House of Penna., Hjelmaren, Kotka, 6 cs.
Bowater Paper Co., Humberarm, Corner Brook, 2088 rolls news print.
Davies Turner & Co., London Commerce, London, 50 cs. printing paper.
Brown Bros. & Co., London Commerce, London, 253 bls. rags.
A. W. Fenton, Inc., London Commerce, London, 46 bls. rags.
Castle & Overton, Inc., London Commerce, London, 59 coils old rope.
Baltimore Trust Co., Anfora, Leghorn, 112 bls. rags.
E. J. Keller Co., Inc., Anfora, Marseilles, 43 bls. rags.
Amsinck Sonne & Co., Inc., Anfora, Marseilles, 159 bls. rags.
A. W. Fenton, Inc., Anfora, Marseilles, 238 bls. rags.
Congoleum Co., Anfora, Marseilles, 45 bls. rags.
Castle & Overton, Inc., Eastern Dawn, Rotterdam, 24 bls. rags.
E. J. Keller Co., Inc., Eastern Dawn, Antwerp, 133 bls. rags.
E. J. Keller Co., Inc., Pennsylvanian, Kobe, 725 bls. rags.
E. J. Keller Co., Inc., Arkansas, Copenhagen, 342 bls. rags.
Buck Kiaer & Co., Inc., Tortugas, Hommelvik, 150 bls. sulphite pulp, 25 tons.
Castle & Overton, Inc., Eastern Dawn, Rotterdam, 240 bls. woodpulp.
Castle & Overton, Inc., Samland, Rotterdam, 525 bls. woodpulp.
Johanson Wales & Sparre, Inc., Anavore, Frano, 2280 bls. kraft pulp.
Johanson Wales & Sparre, Inc., Annavore, Kramfors, 1200 bls. sulphite pulp.
Parsons & Whittemore, Inc., Hjelmaren, Helsingfors, 303 bls. woodpulp.
Lagerloef Trading Co., Hjelmaren, Kotka, 167 bls. woodpulp boards.
Lagerloef Trading Co., Hjelmaren, Kotka, 425 rolls woodpulp boards.

PORTLAND, ME., IMPORTS

WEEK ENDING DECEMBER 26, 1925

Paper House of Penna., Natirar, Kotka, 16 cs. print ware
Bulkley Dunton & Co., Seattle Spirit, ——, 300 bls. woodpulp.

NORFOLK IMPORTS

WEEK ENDING DECEMBER 26, 1925

Lagerloef Trading Co., Hjelmaren, Kotka, 912 bls. woodpulp.
Castle & Overton, Inc., West Inskip, Rotterdam, 118 bls. woodpulp.

NEW ORLEANS IMPORTS

WEEK ENDING DECEMBER 26, 1925

Castle & Overton, Inc., Effna, Germany, 299 bls. rags.
Castle & Overton, Inc., Crabford, France, 247 bls. rags.

CHARLESTON IMPORTS

WEEK ENDING DECEMBER 26, 1925

Castle & Overton, Inc., Grete, Germany, 106 bls. bagging.
Castle & Overton, Inc., Sundance, Belgium, 109 bls. bagging.

BOSTON IMPORTS

WEEK ENDING DECEMBER 26, 1925

E. M. Sergeant & Co., Natirar, Hernosand, 1800 bls. sulphite pulp, 304 tons.
Johanson Wales & Sparre, Inc., Natirar, Frano, 3300 bls. kraft pulp, 558 tons.
Johanson Wales & Sparre, Inc., Natirar, Obbola, 3500 bls. kraft pulp, 500 tons.
Pagel Horton & Co., Inc., Natirar, Domsjo, 9000 bls. sulphite pulp, 1500 tons.
Bulkley Dunton & Co., Milos, ——, 2350 bls. woodpulp.
Buck Kiaer & Co., Inc., Tortugas, Hommelvik, 300 bls. sulphite pulp, 50 tons.
Maurice O'Meara Co., Nitonian, Antwerp, 41 bls. bagging.
American Express National Bank, Nitonian, Antwerp, 146 bls. flaxwaste.

BALTIMORE IMPORTS

WEEK ENDING DECEMBER 26, 1925

Bowater Paper Co., Humberarm, Corner Brook, 5433 rolls news print.
G. W. Millar & Co., Yaye Maru, Hamburg, 126 bls. rags.
National Bank of Commerce, Yaye Maru, Hamburg, 72 bls. rags.
S. Shapiro & Sons, Waukegan, Havre, 52 bls. rags.
A. Hurst, Waukegan, Havre, 151 bls. rags.
Castle & Overton, Inc., West Inskip, Rotterdam, 1153 bls. woodpulp.
Bulkley Dunton & Co., Thyra, ——, 1000 bls. wood pulp.
Bulkley Dunton & Co., Milos, ——, 3250 bls. woodpulp.
E. J. Keller Co., Inc., Bilderdyk, Mannheim, 555 bls. woodpulp.
Buck Kiaer & Co., Inc., Tortugas, Hommelvik, 450 bls. sulphite, 75 tons.
Buck Kiaer & Co., Inc., Tortugas, Oslo, 1000 bls. sulphate, 125 tons.

IN TRANSIT TO HOUSTON, TEXAS

Bowater Paper Co., Humberarm, Corner Brook, 722 rolls news print.

IN TRANSIT TO FORT WORTH, TEXAS

Bowater Paper Co., Humberarm, Corner Brook, 249 rolls news print.

To Build Paper Mill at North Portland Harbor

[FROM OUR REGULAR CORRESPONDENT]

PORTLAND, Ore., December 24, 1925.—The George T. Mickle Lumber Company and the Mickle Mills, Portland, will start early next year the building of a paper mill, to cost in excess of $1,000,000, on land adjacent to the Mickle Mills on North Portland harbor. It will probably require at least eight months to complete the plant if work is begun right after January 1, according to A. W. Miller, vice-president and general manager of Mickle Mills.

George T. Mickle, president of the Mickle companies, has been on an extended trip to the East and immediately upon his return to the city December 16 announcement was made that plans and financial assistance was satisfactorily arranged, about $2,000,000 being available for the plant and as an operating surplus.

The Mickle Mills has a tract of 25 acres lying near their present lumber mill, and part of this will be used. It is expected to use for pulp manufacture the by products that have previously been ground for fuel. The surplus electric power of the lumber mill can be utilized for the paper mill, this surplus until now having been disposed of to the stockyards' trolley line and about twenty other industries thereabout.

In conjunction with the erection of the paper mills it is proposed to add 1,000 feet of dock space to the present dock, which is 1,000 feet long, thus providing for the shipping of the paper mill output by water.

The Mickle Lumber Company acquired its present property in 1924 and has been operating continuously since on an eight hour shift, employing three hundred men. It is planned now to double capacity, producing 600,000 feet of lumber a day in order to provide sufficient by products to keep the big paper mills operating, making at least fifty tons of paper products a day.

L. A. Parker to Go With Champion Coated Paper Co.

KALAMAZOO, Mich., December 25, 1925.—Luther A. Parker, who, with the exception of four years, has been directly associated with the Bryant Paper Company of this city since 1907, will January 1 become superintendent of the coating division of the Champion Coated Paper Company, Hamilton, Ohio. He has tendered his resignation as superintendent of the Imperial coating division of the Bryant Paper Company, a position he has held for many years.

"The offer made me by the Champion Coated Paper Company was an exceptionally good one," said Mr. Parker, "and as much as I regret leaving my present associations, I couldn't consistently refuse the offer."

Mr. Parker formerly resided in Hamilton, being then an employee of the Champion Coated Paper Company. He came to Kalamazoo to enter the Bryant ranks and has advanced to his present post at the head of the coating division. He is a member of the Michigan Division of the Pulp and Paper Superintendents' Association.

New York Market Review

Office of THE PAPER TRADE JOURNAL,
Wednesday, December 30, 1925.

With the exception of a little spot trading there was practically a cessation of business in the local paper market during the Christmas holidays. Sales organizations of the leading paper houses have been marking time and are now engaged in preparing plans for an active campaign in the forthcoming year. Manufacturers and dealers are generally gratified with the past year's results and are looking forward with the utmost confidence to the future.

The demand for news print is as strong as ever and is likely to continue for some considerable period of time. The leading papers are mostly enjoying increased circulations and a heavy volume of advertising patronage and are naturally consuming a tremendous amount of news print. Production is increasing steadily although mill stocks are below normal at the present time.

The various grades of board have been in great request of late. A particularly good demand has been experienced for spot supplies of box board. The fine paper market has also exhibited a strong tone although business has naturally quieted down after the holiday boom. Conditions in the coarse paper market are still favorable and the outlook for 1926 is very bright.

Mechanical Pulp

Due to the stock taking period the demand for mechanical wood pulp has lessened although the ground wood market still shows a strong tone. Increased trading is confidently expected after the turn of the year and a feeling of quiet confidence prevails in the industry.

Chemical Pulp

The chemical wood pulp market remains firm and practically unchanged. Demand has fallen off slightly on account of the Yuletide holidays but prices are generally well maintained at previously quoted rates. Spot offerings and offerings for shipment abroad are limited and both foreign and domestic producers are sold well ahead.

Old Rope and Bagging

While business in the old rope and bagging trade is rather dull at the present moment due to seasonal influences, the market is quite sound and prices rule steady. Practically all grades of rope are fairly active and supplies are being absorbed without difficulty. A steady movement of the various grades of bagging is being experienced and prices are holding up well, according to reliable reports.

Rags

The rag market shows a strong undertone despite the usual holiday lull. There is some mill inquiry around for the various grades of rags and all signs indicate a revival of trading in the new year. The imported rag market is practically unchanged. Foreign dealers are still asking high prices and consumers are not inclined to order on any large scale at the present time. The domestic rag situation is satisfactory and sellers are anticipating an active demand from now on.

Waste Paper

There is only a limited demand for waste paper from the paper mills, at the time of writing, and consumers are apparently waiting until after the annual stock taking is concluded following which a lively business may be expected, as consumers will undoubtedly endeavor to fill their requirements at the earliest possible moment. Dealers and packers are looking for a higher market as soon as the mills begin to purchase in large quantities, and the condition of the market is believed to be quite satisfactory.

Twine

Only routine trading has been experienced in the twine market during the past week following the wane of the Christmas shopping season. The continued expansion of the twine industry is confidently expected by most competent observers and the trade is optimistic regarding the future trend of the market. Prices of most grades are well maintained at the recently quoted basis.

CONSTRUCTION NEWS

(*Continued from page 38*)

Weiss. The company is represented by Lazar Schehr 16 Court street, Brooklyn.

Philadelphia, Pa.—George H. Snyder, Inc., has been incorporated to manufacture paper boxes and containers, and deal in other paper products. The incorporators are George H. and Allen G. Snyder, and Edward J. Dorwarth. The company is represented by Herbert Simons, Land Title Building, Philadelphia.

Financial

Plattsburgh, N. Y.—The Saranac Pulp & Paper Company has arranged for an increase in capital from $350,000 to $1,000,000, for general expansion.

Chicago, Ill.—The Pictorial Paper Package Corporation has filed notice of reduction in capital from $1,050,000 to $685,000.

New York, N. Y.—The Saxon Paper Products, Inc., 78 Grand street, has filed notice of increase in capital from $10,000 to $50,000, for expansion.

Montreal, Que.—The St. Maurice Valley Corporation is disposing of a preferred stock issue of $4,300,000, the proceeds to be used in part for the acquisition of the properties of the St. Maurice Paper Company, Ltd., and for a substantial interest in the Belgo-Canadian Paper Company, Ltd., the properties and business of the latter organization to be leased and operated by the St. Maurice Valley Corporation. The company will operate two news print mills with a combined capacity of 195,000 tons of news print per annum, and 18,000 tons of kraft pulp yearly. Sir Herbert S. Holt is president.

Henry Cassidy Presented With Watch

[FROM OUR REGULAR CORRESPONDENT]

HOLYOKE, Mass., December 28. 1925.—Henry Cassidy, superintendent of the Holyoke Division of the American Writing Paper Company, was presented with a gold watch, chain and fob by the employees of the mill Thursday of last week as a token of appreciation. Mr. Cissady has been in the papermaking business forty years, the last seven as superintendent.

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Miscellaneous Markets

Office of THE PAPER TRADE JOURNAL,
Wednesday, December 30, 1925.

During the past week very little business was transacted in the chemical market but manufacturers of all grades express great satisfaction with the progress made in the year just closing. A good volume of contract business for next year has been accepted and prices are being well maintained on the whole. Withdrawals are proceeding in a normal manner and the outlook for the new year is considered to be particularly bright.

BLANC FIXE.—Only a moderate amount of business was transacted in the blanc fixe market. Spot trading continued slow with purchasers inquiring only for limited quantities for prompt delivery. The pulp is still quoted at from $60 to $64 a ton, in bulk, at works, and the powder at from 3¾ to 4 cents a pound in less than car lots.

BLEACHING POWDER.—Due to seasonal conditions, trading in the bleaching powder market was less active last week. Manufacturers report that the year just closing has been very successful and that a satisfactory amount of forward business has been booked. The prevailing quotation for bleaching powder is from $2 to $2.40 per 100 pounds, in large drums, at works.

CAUSTIC SODA.—Contract withdrawals of caustic soda have been large and the market has been very active during the last few months. Manufacturers predict that even larger shipments will be made during the forthcoming year. Caustic soda is selling at from $3.10 to $3.15 per 100 pounds, at works. For less than car load lots the quotation is from $3.76 to $3.91 per 100 pounds.

CASEIN.—There has been a stronger demand of late for both domestic and foreign grades of casein and prices are much firmer. Shipments on standing contracts are proceeding at a satisfactory pace. Domestic casein is now quoted at from 12¾ to 13½ cents a pound and foreign casein at from 13½ to 13¾ cents a pound.

CHINA CLAY.—No material change was reported in the china clay market and both domestic and foreign grades were in fair demand. Shipments against contract have been fairly frequent. Domestic clay continues to be quoted at $8 a ton, f. o. b. mine, and pulverized at $10 a ton. Foreign grades are quoted at from $13 to $22.50 a ton, ship side.

CHLORINE.—Chlorine continues to move steadily and shipments have been excellent. Manufacturers have been booking more forward business lately and prices are being well maintained. Chlorine is selling at 4 cents a pound, in tanks, or multi-unit cars, at works, on contracts; while spot prices remain at around 4½ cents a pound.

ROSIN.—The rosin market has quietened down somewhat. Inquiries have been fairly numerous but actual sales have been very limited due to the holiday lull. Naval stores are quoting rosin at from $13.95 to $14.55, ship side, in barrels of 280 pounds.

SALT CAKE.—The salt cake market displays no radical change. A good portion of the contract business for next year has already been closed and manufacturers express the opinion that deliveries will be large in the near future. Salt cake continues to be quoted at from $17 to $20 a ton, in bulk, at works.

SODA ASH.—The tone of the soda ash market remains very steady and contract withdrawals have been keeping up excellently. A large bulk of the 1926 orders have already been closed. Spot trading continues along routine lines with prices quite steady. Soda ash is quoted at from $1.35 to $1.65 per 100 pounds, in bulk, at works, and spot car lots at from $1.40 to $1.70 for the same quantity.

STARCH.—A fairly good demand has been experienced for starch during the past week and the market is expected to rule firm for some little time. Special paper makers starch is selling at $3.32 per 100 pounds, in bags and barrels.

SULPHATE OF ALUMINA.—The demand for sulphate of alumina during the past week was along routine lines and supplies continued to move in a normal manner. The quotation on sulphate of alumina continues at from $1.40 to $1.50 per 100 pounds for commercial grades and at from $2 to $2.30 for iron free.

SULPHUR.—All grades of sulphur are still in great request and the market displays a strong tone. It is predicted that the consumption for next year will increase enormously. Sulphur is quoted at from $15 to $16 a ton, in bulk, at mine, and at from $20 to $21 a ton, in bulk, ship side.

TALC.—The talc market was very quiet during the past week but manufacturers are optimistic over the condition of the industry and expect a revival of business early in the new year. Prices remain steady at from $17 to $18 a ton, according to grade.

FOX RIVER VALLEY MILLS BUSY

(*Continued from page 32*)

lander to Nekoosa. It will make possible interchange of power, thus remedying a situation in which one plant formerly would suffer a power shortage while the other would have a surplus. The council, however, modified the project to some extent by prescribing a different route than that originally planned. It also limited the voltage to 16,000 volts. It is announced that consruction of the line will be undertaken very soon.

W. J. Fish Gets Patent

Winfield J. Fish, a former Appleton resident, has been granted a patent by the United States patent office at Washington, D. C., on an invention for use in the paper industry. It consists of a packing box for pulp and paper beaters. Mr. Fish is a paper maker by trade and is a son of the late S. N. Fish, of Appleton. He is now living at 103 North C street,in Hamilton, Ohio.

Kimberly-Clark Give Christmas Party

The annual Christmas party for paper mill employees of the Kimberly mill of the KimberlyClark Company was held on the evening of December 21 at the community clubhouse. The program started at 7:30 with several selections by the Kimberly Cecilian band. "Jingle Bells" was sung by a number of girl employees. S. F. Shattuck, Neenah, treasurer of the company, gave a short talk on behalf of the company. "Oh Come, All Ye Faithful" was sung by a girls' quartet and Christms chimes were played. Several Christmas carols were sung in Dutch by a family of this Netherlands-American community.

Port Alfred News Mill Completed

PORT ALFRED, Que., December 28, 1925.—A visitor to Port Alfred, Que., says the *Pulp and Paper Magazine*,, will be surprised to see the amount of activity on the shores of Ha Ha Bay. By the side of the sulphite mill, which has been operated for some years by the Bay Sulphite Company, recently reorganized as the Port Alfred Pulp and Paper Corp., there stands a fine new mill for the manufacture of news print paper. Under the expert supervision of Geo. McKee, president of the company, and with the experienced guidance and planning of H. S. Taylor, consulting engineer, of Montreal, the buildings have been erected in record time. The use of concrete has not only saved some construction cost, but has made it possible for the walls to be constructed according to schedule, which has greatly facilitated the placing of the steel; in fact, all outside work has been completed and the buildings closed in before the cold weather of the northern climate has had time to interfere with progress. The closing in of the buildings has, of course, greatly facilitated arrangements for the erection of machinery, and this impotant work is now going forward. The team work that has been displayed throughout the construction period by Mr. McKee and Mr. Taylor, and the firms executing contracts and sub-contracts, has been complete, and is a great credit to the designing and planning ability of the engineer, as well as the execution accomplished by the contractors.

There seems to be no doubt that paper will be running over the big Bagley & Sewall machines early in April.

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Market Quotations

Quoted by Hepburn & Co., 74 Broadway, N. Y. City, to whom all inquiry for quotations on these or any other Securities is referred.

BONDS	BID	OFFERED
Abitibi Power and Paper, Gen. 6s 1940	100	102
Advance Bag and Paper, 7s 1943	98	100*
Brompton Pulp and Paper, 6s 1927	94	96
Beaver Board, 8s 1933	92	94
Bedford Pulp and Paper, 6½s 1942	98	...
Berkshire Hills Paper Co., 8s 1941		80
Beaver Products Corp., 7½s 1942	104	106
Belgo Canadian Paper, 6s 1943	100	102
Brown Paper Co., 8s 1931	102	...
Berlin Mills, 5s 1942	98	...
Bryant Paper Co., 6s 1942	99	102*
Brown Campany, Serial, 6s 1925-43	97	100
Central Paper 6½s 1925-42	91	94
Cape Breton Pulp and Paper, 6s 1932	100	...
Carthage Sulphite Pulp and Paper, 8s 1941	40	50
Champion Coated Paper Co., 6s 1924-34	...	102
Champion Fibre Co. Notes, 8s 1930	101	...
Cherry River Paper, 5s 1929	98	100*
Donnaconna Paper Co., Ltd., 6s 1940	95	100*
Eddy Paper, 7½s 1931	100	...
Eagle Paper, 6½ 1932	96	100
Escanaba Paper, 6s 1933	87	95*
Fox River Paper, 7s 1931	100	...
Fort Orange Paper Co., 7s 1942	95	99
Gilbert Paper Co., 7s 1927	96	...
Gilbert Paper Co., 6½s 1923-29	101	102*
Hammermill Paper Co., 6s 1930-39	99	...
Hummell, Ross Fibre Corp., 7s 1925	90	...
Jessup & Moore Paper Co., 6s 1945	98½*	100
Lake Superior Pulp and Paper, 6s 1941	105	...
Mattagami Pulp and Paper, 6s 1937	90	...
Marinette & Menominee, 7½s 1936	104	...
National Paper and Type, 6s 1947	96	99*
Oswego Falls Corp., 8s 1942	102	105
Orono Pulp and Paper, 5s 1941	93	96*
Orono Pulp and Paper, 6s 1943	97	100*
Oxford Paper Co., 6s 1947	100	...
Paterson Parchment Paper, 5½s 1927-28	98	100
Paterson Parchment, 6s 1938	98	100*
Parker Young Co., 6½s 1944	92	96
Price Bros., Ltd., 6s 1943	100	...
Provincial Paper Mills, Ltd., 6s 1940	97	...
Riordon Co., Series A, 8s 1940	115	118
Riordan Paper, 6s 1924	99	101
Riordan Pulp and Paper, Ltd., 6s, 1929	33	35
River Raisin Paper, 8s 1936	104	106
St. Maurice Paper Co., Ltd., 5½s, 1929	98½	99¾
St. Regis Paper, 6½ s, 1929-35	97	102
Smith (Howard) Paper Mills, 7s 1941	96	99
Smith (Howard) Paper Mills, 6s 1934	98	...
St. Croix Paper, 5s 1923-37	95	...
Stevens & Thompson Paper, 6s 1942	85	92
Spanish River Pulp and Paper, 6s 1931	105	108
Spanish River Pulp and Paper, Gen 8s 1941	106	109
Ticonderoga Pulp and Paper Co. 6s 1940	91	95
Ticonderoga Pulp & Paper 1-5, 1930	88	93
S. D. Warren Company, 6s, 1945	97	100
Whittaker Paper, 1st 7s 1942	99	101
Watab Paper Co., 6½s 1942	100	104
Waterway Paper Products, 7s 1924-27	95	100
Wayagamack Pulp and Paper, Ltd., 6s 1951	88	90

STOCKS	BID	ASKED
Abitibi Power and Paper, Com	67	70
Abitibi Power and Paper, Pfd	103	...
Advance Bag and Paper, Com	8	12*
Advance Bag and Paper, Pfd	77	...
American Writing Paper Co., Com	½	¾
American Writing Paper Co., Pfd	1½	2
American Writing Paper Co., Certificates	¾	1
Beaver Board, Com	4	6
Beaver Board, Pfd	34	37
Bryant Paper, Cap	12	...
Bryant Paper, Pfd	9	...
Chicago Mill & Lumber Co., Com	63	...
Chicago Mill & Lumber Co., Pfd	98	104
Crown Williamette, Com	93	98*
Crown Williamette, 7% A, Pfd	98	SW
Donnaconna Paper, Com	49	54
Donnaconna Paper, Pfd	95	100
Great Northern Paper, Cap	260	270
International Paper Co., Com	63	65
International Paper Co., Pfd., 6%	85	90
International Paper, 7% Pfd	97	100
Jessup & Moore Paper, Pfd	85	...
Oxford Papers, Com	102	...
Oxford Paper Co., Pfd	100	...
Provincial Paper Co., Com	94	98
Provincial Paper Co., Pfd	99	...
Price Brothers, Cap	47	50
St. Croix Paper	185	215
St. Maurice Paper Co., Cap	83	85
St. Regis Paper Co., Cap	54	56
Spanish River Pulp and Paper, Com	103	105
Spanish River Pulp and Paper, Pfd	115	120
West Virginia Pulp and Paper, Cap	...	49
West Virginia Pulp and Paper, Cap	...	47
West Virginia Pulp and Paper, Pfd	95	105
Whittaker Paper, Com	52	58
Whittaker Paper, Pfd	90	...

* Nominal.

Paper

(F. o. b. Mill)

Ledgers	11.00	@38.00
Bonds	9.00	@45.00
Writings—		
Extra Superfine	14.00	@32.00
Superfine	14.00	@32.00
Tub sized	10.00	@15.00
Engine Sized	8.00	@11.00
News—		
Rolls, contract	3.50	@ 3.90
Rolls, contract, '26	3.25	@ 3.65
Rolls, transit	3.75	@ 4.25
Sheets	4.00	@ 4.25
Side Runs	3.25	@ 4.00
Book, Cased—		
S. & S. C.	7.00	@ 9.75
M. F.	6.25	@ 8.75
Coated and Enamel	8.00	@15.00
Lithograph	8.00	@15.00
Tissues—Per Ream—		
White No. 1	.80	@ 1.00
Anti-Tarnish	1.10	@ 1.90
Colored	1.00	@ 2.00
White No. 2	.75	@ .85
Kraft	.90	@ 1.00
Manila	.75	@ .85
Kraft—		
No. 1 Domestic	6.25	@ 6.50
No. 2 Domestic	5.50	@ 6.00
Southern	4.75	@ 5.25
Imported	6.50	@ 7.00
Manila—		
No. 1 Jute	9.00	@ 9.25
No. 2 Jute	7.75	@ 8.50
No. 1 Wood	4.75	@ 5.25
No. 2 Wood	4.00	@ 4.50
Butchers	3.75	@ 4.25
Fibre Papers—		
No. 1 Fibre	5.00	@ 5.50
No. 2 Fibre	4.75	@ 5.25
Common Bogus	2.75	@ 3.00
S. Screening	3.00	@ 3.50
Card Middles	4.00	@ 5.00
Boards—per ton—		
News	45.00	@47.50
Straw	57.00	@60.00
Chip	42.00	@45.00
Binders' Boards	72.50	@77.50
Sgl. Mla. L.l. Chip.	58.00	@60.00
Wood Pulp	70.00	@75.00
Container	62.50	@67.50
Sulphate Screenings—		
Coarse	.75	@ .85
Refined	1.75	@ 2.00
Ground Wood—		
Screenings	20.00	@25.00
Glassine—		
Bleached, basis 25 lbs.	13.00	@16.00
Bleached, basis 20 lbs.	15.00	@16.00

Mechanical Pulp

(Ex-Dock)

No. 1 Imported—		
Moist	35.00	@40.00
Dry	38.00	@42.00
(F. o. b. Mill)		
No. 1 Domestic	28.00	@32.00

Chemical Pulp

(Ex-Dock, Atlantic Ports)

Sulphite (Imported)—		
Bleached	4.25	@ 4.50
Easy Bleaching	3.55	@ 3.60
No. 1 strong unbleached	3.05	@ 3.25
No. 2 strong unbleached	2.80	@ 3.05
No. 1 Kraft	3.10	@ 3.35
Sulphate—		
Bleached	3.75	@ 4.00
(F. o. b. Pulp Mill)		
Sulphite (Domestic)—		
Bleached	4.00	@ 4.75
Easy Bleaching Sulphite	3.00	@ 3.25
News Sulphite	2.90	@ 3.00
Mitscherlich	3.25	@ 3.75
Kraft (Domestic)	3.00	@ 3.50
Soda Bleached	4.00	@ 4.25

Domestic Rags

New Rags

Prices to Mill f. o. b. N. Y.

Shirt Cuttings—		
New White, No. 1	14.50	@15.00
New White, No. 2	8.00	@10.00
Silesias No. 1	9.75	@10.50
New Unbleached	14.00	@14.70
Washables	8.00	@ 8.25
Fancy	9.25	@ 9.75
Blue Overall	11.50	@11.75
New Blue Prints	7.25	@ 7.75
New Soft Blacks	5.75	@ 6.00
Mixed Khaki Cuttings	6.75	@ 7.25
Pink Corset Cuttings	11.25	@11.75
Pink Muslin	10.00	@10.50
New Light Seconds	3.50	@ 3.75
O. D. Khaki Cuttings	7.00	@ 7.50
Men's Corduroy	5.75	@ 6.25
New Mixed Blacks	4.00	@ 4.50

Old Rags

White, No. 1—		
Repacked	6.75	@ 7.25
Miscellaneous	6.25	@ 6.75
White, No. 2—		
Repacked	4.00	@ 4.25
Miscellaneous	3.50	@ 3.75
St. Soiled, White	2.90	@ 3.00
Thirds and Blues—		
Repacked	3.75	@ 4.00
Miscellaneous	3.00	@ 3.25
Black Stockings	3.75	@ 4.25
Roofing Rags—		
Cloth Strippings	2.10	@ 2.20
No. 1	2.10	@ 2.20
No. 2	1.80	@ 1.90
No. 3	1.50	@ 1.60
No. 4	1.60	@ 1.70
No. 5A	1.00	@ 1.15

Foreign Rags

New Light Silesias	10.00	@11.00
Light Flannelettes	10.50	@11.75
Unbleached Cottons	14.00	@14.50
New White Cuttings	14.00	@15.00
New Light Oxfords	10.00	@10.50
New Light Prints	9.00	@ 9.50
New Mixed Cuttings	4.25	@ 4.50
New Dark Cuttings	4.00	@ 4.25
No. 1 White Linens	10.00	@11.00
No. 2 White Linens	7.25	@ 8.25
No. 3 White Linens	6.25	@ 6.75
No. 4 White Linens	4.50	@ 5.50
Old Extra Light Prints	4.25	@ 4.75
Ord. Light Prints	3.25	@ 3.75
Med. Light Prints	2.50	@ 3.00
Dutch Blue Cottons	3.50	@ 4.00
Ger. Blue Cottons	2.75	@ 3.00
Ger. Blue Linens	4.00	@ 4.25
Checks and Blues	3.25	@ 3.50
Linsay Garments	2 10	@ 2.25
Dark Cottons	1.95	@ 2.05
Shoppery	2.00	@ 2.10
French Blues	3.50	@ 4.00

Bagging

Prices to Mill F. o. b. N. Y.

Gunny No. 1—		
Foreign	3.60	@ 4.00
Domestic	3.75	@ 4.00
Wool Tares, light	2.90	@ 3.10
Wool Tares, heavy	3.00	@ 3.25
Bright Bagging	2.85	@ 3.00
Mixed Bagging	2.40	@ 2.50
Sound Bagging	2.10	@ 2.20
Roofing Bagging	1.75	@ 1.80
Small Mixed Rope	2.25	@ 2.50
Manila Rope—		
Foreign	5.25	@ 5.50
Domestic	6.50	@ 6.75
New Bu. Cut	4.00	@ 4.25
Hessian Jute Threads—		
Foreign	4.50	@ 5.00
Domestic	4.25	@ 4.75

Old Waste Papers

F. o. b. New York)

Shavings—		
Hard, White, No. 1	3.65	@ 3.85
Hard, White, No. 2	3.15	@ 3.25
Soft, White, No. 1	2.95	@ 3.20
Flat Stock—		
Stitch'ess	1.30	@ 1.40
Overissue Mag.	1.30	@ 1.40
Solid Flat Book	1.15	@ 1.25
Crumpled No. 1	.85	@ .95
Solid Book Ledger	1.75	@ 2.00
Ledger Stock	1.50	@ 1.65
New B. B. Chips	.60	@ .70
Manilas—		
New Env. Cut	2.65	@ 2.80
New Cut No. 1	1.65	@ 2.00
Extra No. 1 old	1.20	@ 1.30
Print	.75	@ .85
Container Board	.60	@ .70
Bogus Wrapper	.75	@ .85
Old Krafts Machine compressed bales	2.40	@ 2.55
News—		
No. 1 White News	1.95	@ 2.05
Strictly Overissue	.75	@ .85
Strictly Folded	.65	@ .70
No. 1 Mixed Paper	.45	@ .50
Common Paper	.30	@ .35

Twines

(F. o. b. Mill)

Cotton—		
No. 1	.39	@ .42
No. 2	.38	@ .40
No. 3	.37	@ .39
India, No. 6 basis—		
Light	.21	@ .22
Dark	.19	@ .21
B. C., 18 basis	.39	@ .41
A. B. Italian, 18 basis	.56	@ .61

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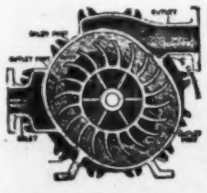

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for making any style envelope, regular or special. Printed, stamped, embossed and tissue lined envelopes. Also die presses, tension machines, metal clasp machines, and all other machinery used in making envelopes.

633 West 44th Street — New York, N. Y.

Jute—			
Dark, 18 basis	.30	@	.31
Light, 18 basis	.28	@	.30
Jute Wrapping, 3-6 Ply—			
No. 1	.22	@	.24
No. 2	.20½	@	.22½
Tube Rope—			
4-ply and larger	.16	@	.19
Tube Yarn—			
4-ply and larger	.20	@	.28
4-ply	.21	@	.24
	.22	@	.25

Unfinished Jute—			
Basis	.15½	@	.16½
Paper Makers' Twine			
Balls	.12	@	.13
Box Twine, 2-3 ply	.15	@	.17
Jute Rope	.20	@	.40
Ameri. Hemp, 6	.30	@	.32
Sisal Hay Rope—			
No. 1 Basis	.16	@	.18
No. 2 Basis	.10	@	.13
Sisal Lath Yarn—			
No. 1	.14	@	.15
No. 2	.11	@	.13
Manila Rope	.20	@	.21

CHICAGO

Paper

F. o. b. Mill			
All Rag Bond	35	@	40
No. 1 Rag Bond	25	@	35
No. 2 Rag Bond	14	@	25
Water Marked Sulphite	9	@	12
Sulphite Bond	7	@	10¾
Sulphite Ledger	9	@	12
Superfine Writing	18	@	24
No. 1 Fine Writing	14	@	18
No. 2 Fine Writing	12	@	14
No. 3 Fine Writing	9	@	12
No. 1 M. F. Book	5½	@	7½
No. 1 S. & S. C. Book	6	@	7¾
Coated Book	7½	@	10
Coated Label	7½	@	10
News—Roll, mill	3½	@	4¼
News—Sheets, mill	3¾	@	4¾
No. 1 Manila	4¾	@	5¾
No. 1 Fibre	4¾	@	5¼
No. 2 Manila	4¼	@	4¾
Butchers' Manila	4	@	4½
No. 1 Kraft	6	@	6½
Southern Kraft	4½	@	5
No. 2 Kraft	5¼	@	5¾
Wood Tag Boards	4¼	@	6¼
Sulphite Screenings	3	@	3¼
Manila Tissue, 24x36 sheet	7¼	@	7¾
White Tissue, 20x30 sheet	7¼	@	7½
Boards, per ton—			
(Delivered Central Territory)			
Plain Chip	45.00	@	47.50
Solid News	48.50	@	50.00
Manila Line Chip	57.50	@	60.00

Container Lined—			
(Delivered Central Territory)			
85 Test	—	@	75.00
100 Test	—	@	80.00

Old Papers

F. o. b. Chicago

Shavings—			
No. 1 Hard White	3.50	@	3.60
White Envel. Cuttings	3.40	@	3.50
No. 1 Soft Shav.	2.90	@	3.00
No. 1 Mixed	—	@	—
No. 2 Mixed	1.15	@	1.20
Ledger and Writings	1.55	@	1.60
Solid Books	1.40	@	1.50
No. 1 Light Books	1.80	@	1.85
Blanks	2.00	@	2.10
Kraft	2.50	@	2.75
New Kraft Cuts	2.70	@	2.80
Manila Envelope Cuttings	2.40	@	2.50
Ex. No. 1 Manila	2.00	@	2.10
Print Manila	.95	@	1.10
Folded News (oversize)	.90	@	.95
Old Newspapers—			
No. 1	.80	@	.85
No. 2	.70	@	.75
Mixed Papers—			
No. 1	.65	@	.70
No. 2	.50	@	.60
Roofing Stocks, f. o. b. Chicago, Net Cash—			
No. 1	47.00	@	52.00
No. 2	45.00	@	50.00
No. 3	43.00	@	48.00
No. 4	41.00	@	46.00

BOSTON

Paper

Ledgers—			
Sulphite	.08½	@	.18
Rag content	.18	@	.36½
All Rag	.38	@	.50
Bonds—			
Sulphite	.07½	@	.10¾
Rag Content	.17	@	.45
All Rag	.36½	@	.51
Writings	.08	@	.20
Superfines	.22	@	.30
News	.04	@	.04½
Book, Super	.08	@	.10
Book, Coated	.09	@	.14
Coated Litho	.09½	@	.15
Label	.09½	@	.15
Jute Manila No. 1	.11	@	.13
Manila, Sul. No. 1	.05	@	.05
Manila, Sul. No. 2	.03¾	@	.04¼
No. 1 Kraft	.05¾	@	.06½
No. 2 Kraft	.05¼	@	.05¾
Common Bogus	.02½	@	.02¾
Straw Board	—	@	50.00
News Board	—	@	47.50
Chip Board	—	@	45.00
Single Manila Pulp lined board	57.50	@	60.00
Single White, patent coated board	75.00	@	82.50
Wood Pulp Board	80.00	@	85.00
Binder Boards	75.00	@	85.00
Tarred Felts—			
Regular	61.00	@	63.00
Slaters	66.00	@	68.00
Best Tarred, 1 Ply, roll	1.50	@	1.60
Best Tarred, 2 Ply, roll	1.70	@	1.80
Best Tarred, 3 Ply, roll	2.00	@	2.10

Old Papers

Shavings—			
No. 1 Hard White	3.75	@	4.00
White Blank News	1.75	@	2.00
Manila Env. Cuttings	2.80	@	3.00
No. 2 Hard White	3.25	@	3.50
No. 1 Soft White	.82½	@	.83
No. 2 Soft White	.82½	@	.83
No. 1 Mixed	1.60	@	1.75
No. 2 Mixed	1.25	@	1.30
Solid Ledger Stock	1.60	@	1.75
No. 1 Books, Heavy	1.25	@	—
No. 1 Books, Light	—	@	1.25
No. 1 New Manila	2.50	@	2.60
No. 1 Old Manila	1.75	@	2.00
Print Manila	1.05	@	1.20
Old Kraft	2.25	@	2.35
Overissue News	1.00	@	1.10
Old Newspapers	.70	@	.85
No. 1 Mixed Paper	.40	@	.47½
Box Board, Chip	.60	@	.50

Bagging

Price f. o. b. Boston

Gunny No. 1—			
Foreign	—	@	3.37½
Domestic	—	@	3.50
Manila Rope	—	@	5.50
Mixed Rope	2.00	@	—
Scrap burlaps	—	@	2.37½
Wool Tares, heavy	2.50	@	2.75
Mixed Strings	—	@	1.90
New Burlap Cutting	—	@	3.25

Domestic Rags (New)

Price f. o. b. Boston

Shirt Cuttings—			
New White No. 1	.15½	@	.15
Silesias, No. 1	.11	@	—
New Unbleached	.14½	@	.15
Washable	.07¾	@	.08
Fancy	.10½	@	—
Cottons—According to Grades—Blue—			
Blue overalls	12½	@	—
New Black, soft	.07	@	—
Khaki Cuttings	.07	@	—
Corduroy	.04	@	.05
New Canvas	.12	@	.12½

Domestic Rags (Old)

Price f. o. b. Boston

White No. 1	10.00	@	—
Repacked	9.50	@	—
Miscellaneous	8.50	@	—
White No. 2—			
Repacked	6.50	@	—
Miscellaneous	5.25	@	—
Thirds and Blues—			
Repacked	5.00	@	—
Miscellaneous	3.50	@	—
Roofing Stock—			
No. 1	2.15	@	—
No. 2	1.90	@	—
No. 3	1.75	@	—
No. 4	1.90	@	—

PHILADELPHIA

Paper

Bonds	.07	@	.40
Ledgers	.11	@	.40
Writings—			
Superfine	.13	@	.18
Extra fine	—	@	.22
Fine	.20	@	.26½
Fine, No. 2	.16	@	.25
Fine, No. 3	.12	@	.20
Book, M. F.	.06¾	@	.07
Book, S. S. & C.	.06	@	.07½
Book, Coated	.11	@	.16
Coated Lithograph	.09	@	.12
Label	.09	@	.12
News	.03¾	@	.04
No. 1 Jute Manila	.09½	@	—
Manila Sul., No. 1	.04½	@	.06
Manila No. 2	.04	@	.04½
No. 2 Kraft	.05¼	@	.05¾
No. 1 Kraft	.06¼	@	.06½
Common Bogus	.02¾	@	—
Straw Board	56.00	@	55.00
News Board	45.00	@	—
Chip Board	47.50	@	—
Wood Pulp Board, 4.50		@	5.00

(Carload Lots)

Binder Boards—			
Per ton	75.00	@	80.00
Carload lots	65.00	@	70.00
Tarred Felts—			
Regular	66.00	@	68.00
Slaters	70.00	@	72.00
Best Tarred, 1-ply (per roll)	1.85	@	1.95
Best Tarred, 2-ply (per roll)	1.55	@	1.70
Best Tarred, 3-ply	2.10	@	2.15
No. 1 Mixed Paper	.65	@	.70

Domestic Rags—New

Price to Mill, f. o. b. Phila.

Shirt Cuttings—			
New White, No. 1	.13½	@	.14
New White, No. 2	.06	@	.08
Silesias, No. 1	.10½	@	.11
New Unbleached	.14	@	.14½
Washable	.07½	@	.07¾
Fancy	.09½	@	.10
Cottons—according to grades—			
Blue Overall	.11	@	.12
New Blue	.04	@	.04¼
New Black Soft	.06	@	.06¼
New Light Seconds	.03½	@	.03¾
Khaki Cuttings	.06½	@	.07
Corduroy	.04	@	.04½
New Canvas	.08¾	@	.09
New Black Mixed	.05	@	.05½

Bagging

F. o. b. Phila.

Gunny, No. 1—			
Foreign	3.00	@	3.25
Domestic	3.00	@	3.25
Manila Rope	4.75	@	6.00
Sisal Rope	2.50	@	—
Mixed Rope	1.00	@	1.25
Scrap Burlaps	2.25	@	2.50
Wool Tares, heavy	2.00	@	2.13
Mixed Strings	1.25	@	—
No. 1, New Lt. Burlap	3.50	@	3.75
New Burlap Cuttings	3.25	@	3.50

Old Papers

F. o. b. Phila.

Shavings—			
No. 1 Hard White	3.50	@	3.60
No. 2 Hard White	3.00	@	3.25
No. 1 Soft White	2.60	@	2.70
No. 2 Soft White	2.00	@	2.20
No. 1 Mixed	1.50	@	1.60
No. 2 Mixed	1.00	@	1.10
Solid Ledger Stock	1.75	@	1.90
Writing Paper	1.60	@	1.80
No. 1 Books, heavy	1.30	@	1.40
No. 2 Books, light	1.20	@	1.25
No. 1 New Manila	1.80	@	2.00
No. 1 Old Manila	1.60	@	1.75
Print Manila	1.25	@	1.35
Container Manila	1.00	@	1.10
Old Kraft	2.00	@	2.10
Common Paper	.50	@	.60
Straw Board, Chip	.60	@	.65
Binders Bd., Chip	.60	@	.65
Over issue News	.85	@	1.00
Old Newspaper	.70	@	.75

Old

White, No. 1—			
Repacked	6.75	@	7.00
Miscellaneous	6.25	@	6.50
White, No. 2—			
Repacked	.05	@	.05¼
Miscellaneous	.04¾	@	.05
Thirds and Blues—			
Repacked	3.75	@	4.00
Miscellaneous	2.75	@	3.00
Black Stockings	4.25	@	4.50
Roofing Stock—			
No. 1	2.00	@	2.15
No. 2	1.90	@	2.00
No. 3	1.25	@	1.35
No. 4	1.10	@	1.20
No. 5A	1.10	@	1.15
B	1.05	@	1.10
C	1.00	@	1.05

TORONTO

Paper

(Mill Prices to Jobbers f. o. b. Mill)

Bond—			
Sulphite	.10¼	@	.12½
Light tinted	.11	@	.13½
Dark tinted	.12½	@	.15
Ledgers (sulphite)	—	@	.13
Ledgers No. 1	.36	@	—
Ledgers No. 2	.27	@	—
Writing	.09½	@	—
Writing S. C.	.10	@	—
News f. o. b. Mills—			
Rolls (carloads)	3.50	@	—
Sheets (carloads)	—	@	4.25
Sheets (2 tons or over)	—	@	4.60
Book—			
No. 1 M. F. (carloads)	8.00	@	—
No. 2 M. F. (carloads)	7.50	@	—
No. 3 M. F. (carloads)	7.00	@	—
No. 1 S. C. (carloads)	8.50	@	—
No. 2 S. C. (carloads)	8.00	@	—
No. 3 S. C. (carloads)	7.50	@	—
No. 1 Coated and litho	14.50	@	—
No. 2 Coated and litho	13.50	@	—
No. 3 Coated and litho	12.75	@	—
Coated tinted	.15	@	—
Wrapping—			
Rag Brown	4.75	@	—
White Rag	5.25	@	—
"B" Manila	1.50	@	—
No. 1 Manila	4.50	@	—
Fiber	4.50	@	—
Kraft, M. F.	7.00	@	—
M. G.	7.15	@	—

Pulp

(F. o. b. Mill)

Ground wood	30.00	@	32.50
Sulphite easy bleaching	60.00	@	65.00
Sulphite news grade	55.00	@	58.00
Sulphite, bleached	75.00	@	80.00
Sulphate	72.50	@	73.00

Old Waste Paper

(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. cut	3.65	@	—
Soft White Book shavings	—	@	3.15
White Blk, News	1.70	@	—
Book and Ledger—			
Flat Magazine and Book Stock (old)	1.25	@	—
Light and Crumpled Book Stock	1.10	@	—
Ledgers and Writings	1.40	@	—
Solid Ledgers	1.40	@	—
Manilas—			
New Manila Cut	—	@	1.60
Printed Manilas	1.10	@	—
Kraft	2.25	@	—
News and Scrap—			
Strictly Overissue	.90	@	—
Folded News	.90	@	—
No. 1 Mixed Papers	.70	@	—

Domestic Rags—

Price to mills, f. o. b. Toronto

Per lb.

No. 1 White shirt cuttings	.14½	@	.14½
No. 2 White shirt cuttings	.08	@	.08½
Fancy shirt cuttings	.09½	@	.10
No. 1 Old Whites	—	@	—
Third and blues			—

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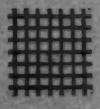

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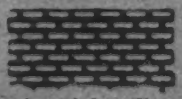

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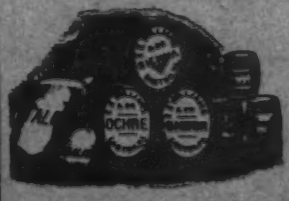

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